NOVEMBER 1961 3/6

AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS

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AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS VOL 3 No 11

NOVEMBER 1961

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Price for 12 issues post paid:
United Kingdom and Eire 45s.
USA $6.50
Canada $6.00
Other countries 45s. or Local currency equivalent

AUTOMATIC DATA PROCESSING

is published monthly by Business Publications Ltd.

Advertisement, editorial and sales offices: Mercury House, 109-119 Waterloo Road, London, S.E.1. (Waterloo 3388.)

Change of subscriber's address: Please notify publishers six weeks before change of address is to take effect, giving present address in full and new address.

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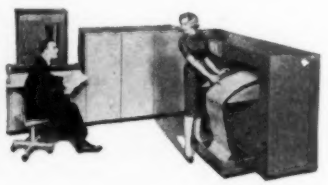


Small comfort for the smaller user

WHAT was wrong with the Electronic Data Processing Symposium held last month at Olympia—and in hindsight it appears so obvious that one shudders at the mistake—was that too many of the papers were written by people from *very large* firms, at the expense of the smaller company. Before the organisers of the symposium collectively reach for their pens to denounce this atrocious allegation, let's do a little qualifying and general gun-spiking. I know that the large companies—Fords, Standards, Boots, Stewart and Lloyds and Glaxo Laboratories—have the most experience in the commercial applications of computers, and that it was thought natural that representatives of these companies should be asked to 'pass on gratuitously' some of their hard earned experience (though it may be worth asking if anyone checked on how transferable this experience might be). I also realise that two papers were written by people who belong to what one can class as 'smaller firms'—Mr R B Baggett's paper on how his company use a computer bureau for controlling production and forecasting sales was even more interesting than the paper he gave to a similar symposium three years ago, and Mr S A Emery's paper provided another instance of how a small company can make profitable use of a service bureau.

Still, only two papers—out of some 26—devoted to the smaller user rates, at best, as a considerable oversight, and at worst, as a lack of balance. If a symposium of this kind is intended to explain and impress the value of electronic data processing to the bulk of British companies and to make some contribution in persuading firms to adopt more efficient methods, then perhaps the last people that should be invited to write papers are the representatives of very large organisations—because, for the average businessman running a small or medium-size business, it seems that what large firms do bears no relation to the problems that confront him.

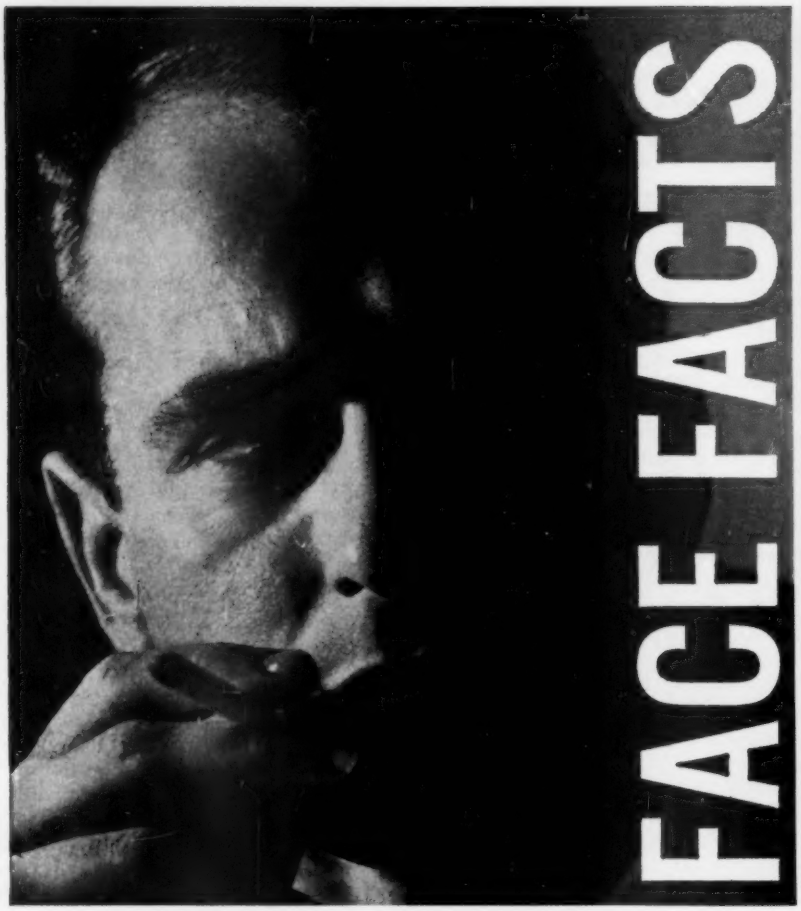
This said, it has to be admitted that it would be difficult to mount a symposium based exclusively on retailing the experiences of smaller firms—difficult, but not impossible; the first business computer symposium in 1958, did after all rely to some considerable extent on what companies intended to do in the future: medium size companies may prefer to hear what their equivalents in other industries intend to do in the future rather than what the giants are doing now.

Whenever computer service bureaux are mentioned somebody can be counted on to say, almost ritualistically, that they are the hope of the smaller firm. Mr Dudley Hooper, President of the British Computer Society, in an excellent paper on computer bureaux proves disillusioning on this point.

'The computer bureau,' he writes, 'has not yet become an accepted adjunct to, or substitution for, the normal data processing facilities of many thousands of small businesses in the United Kingdom. Many are slow to overcome deep and traditional suspicions of allowing information, much of which must be confidential, to pass out of their possession. . . .'

On the other hand, if 'the many thousands' came flocking to the bureaux, it is doubtful if they could handle the work—for they are not yet equipped to accept large volumes of information for processing (the input bottleneck) or, in some cases, to print results out fast enough.

Come the time when manufacturers can offer full services, then the smaller user will have no excuse.



FACE FACTS

- Payroll
- Personnel statistics
- Order processing
- Production scheduling
- Production planning
- Stock control
- Purchase accounting
- Order invoicing and warehouse stock control
- Cost collection
- Costing and budgetary control
- Invoicing
- Sales ledger
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DATA DIGEST

Ordered last month — 13 Computers

A quick check shows that an unusually large number of computer orders were announced last month, but this should not be interpreted as an 'upward trend' in computer sales, for the facts merely seem to indicate that a number of prospective orders involving long negotiations 'came to the boil' almost simultaneously. Of the 13 orders taken, five are to be installed at universities and one at a government scientific establishment (one of the UKAEA's centres); the remaining seven systems, when installed, will be used for data processing (rather than scientific) work.

London University, at a cost of approximately £2 million, are to install a Ferranti Atlas computer towards the end of 1963. London University have been working a Ferranti Mercury computer since 1959, and the new machine will be established in Gordon Square, London, WC1, and will be the responsibility of the University's computer unit. Computer facilities for all of the colleges of London University and for many outside organisations will be available once the Atlas system is operating.

Approximately half a million pounds—a quarter of the cost of the computer—is being provided for the university by the British Petroleum Co. In return British Petroleum will have use of the system for considerable periods of time for five years after the installation starts running, and plan to use this for a full-scale investigation into the company's refinery and supply programme.

Atlas will be nearly 100 times faster than the University's present Mercury machine, and will be able to carry out simple instructions (*eg.* additions) at the rate of a million a second.

The United Kingdom Atomic Energy Authority recently signed a contract to take delivery of an IBM Stretch computer next year. This in fact is only a confirmation of a tentative order made in July 1960. Last month it was announced that the UKAEA were also to have a Ferranti Atlas computer.

The Universities of Birmingham, Glasgow, Leeds and **Liverpool** have each ordered an English Electric KDF 9 computer. Probable costs to the universities who will put their machines to work on the ever-increasing volume of computation involved in present-day research projects, will be £630,000 a machine. The Universities of Glasgow and Liverpool already operate Deuce II machines, and the University of Leeds has a Pegasus computer.

Thomas Hedley and Co. Ltd, the soap, detergent and edible fat manufacturers, are to set up a data processing centre at their Newcastle upon Tyne head office. The centre will be equipped with a National 315 computer, and will tackle mixed work—commercial data processing and scientific calculations for the company's engineers and research chemists, though the latter type of work will only occupy a fraction of the time available on the computer. Hedley's do not state what data processing work they plan for their machine, but sales invoicing and controlling stock are likely to be two of the tasks the company will want to computerise. Hedley's are not the only soap company who have investigated computers: **Colgate-Palmolive Ltd,** who manufacture soap, detergents and toilet preparations, spent five years studying the use of computers for business data processing, and this culminated in a 'letter of intent' to EMI late last year specifying an Emidec 1100.

Although Colgate will not in fact install an Emidec 1100—the American parent company vetoed the project—the company have worked out in some detail which of their operations could be computerised — invoicing, stock control, vehicle loading schedules, as well as preparing monthly statements of account, and daily summaries of sales.

Esso Petroleum (Ireland) Ltd have ordered an ICT 1301 computer. This will be a card machine (*ie.* it will not be equipped with magnetic tape units) and will cost the company some £70,000. Due to be delivered not before 1963, Esso's machine will be used to take over work currently done on punched card equipment: sales accounting, producing the payroll, general accounting including the control of fixed assets and stocks, preparing statistics and investment analyses.

Shell-Mex and BP Ltd, the company that market in Britain the petroleum products of both the Shell and British Petroleum companies, recently ordered a Leo III computer. Shell-Mex and BP first hit the news last year when they announced they had developed a push-button office (see AUTOMATIC DATA PROCESSING, October 1960). Eventually, it is planned that every one of the company's regional sales depots, which receive orders for petroleum products by 'phone, will be equipped with a ' Direct Order Recording and Invoicing System ' (DORIS) —a push-button system which automatically produces invoices and delivery notes as well as recording each sale on paper tape.

It will, of course, be some time before every depot in the Shell-Mex-BP distribution network is equipped with a Doris, but it appears that the Leo III installation will then be used to process data prepared automatically on paper tape at the depots, providing analyses of sales, etc.

Shell-BP's installation is likely to cost more than £250,000 and will be equipped with several magnetic tape units.

Lewis's Investment Trust Ltd, which control the Lewis's and Selfridge's group of department stores, have ordered an ICT 1301 computer, which will be used for ' merchandise accounting ', purchase accounting and other procedures. As Lewis's propose to use the machine to do work for all their stores—the company has stores in Birmingham, Bristol, Glasgow, Hanley, Leeds, Leicester, Liverpool and Manchester, apart from Selfridge's store in London—it seems likely that their machine, which will be equipped with magnetic tape units, will cost over £200,000. Lewis's are the first department store group to announce that they propose to use a computer.

The Ford Motor Co. Ltd, no newcomers to computers for they already operate two machines, recently ordered a Leo III system. The new machine will cost some £300,000 and will replace a Leo II machine at the company's spare parts depot at Aveley. A second Leo II machine is in operation at Ford's Dagenham plant.

The Borough of Hornsey in Middlesex, with some 600 employees and a population of about 100,000, has ordered from Standard Telephones and Cables Ltd a Stantec data processing system. The system will be used to prepare the weekly payroll for the 600 Borough employees, to keep records of over 2,000 commodities stored, to prepare council accounts, and to bill for rate payments.

Eventually, the machine will be used in a comprehensive rates system which will be kept up-to-date on such facts as changes of occupier and variations of assessment and allowances. Records of payments will be kept and the computer will be able to pick out non-payers, print reminders, seven-day notices and, in certain necessary cases, summons.

Although conventional records will be largely replaced by punched paper tape records, Hornsey will still be able to answer individual enquiries for a Creed paper tape store is to be installed, in the public office. This will provide quick reference to any item required, for any block of information on paper tape will be readily found and printed out from the tape store merely by dialling a number on an ordinary telephone dial.

The Eire Revenue Commissioners, who have employed punched card equipment during the last 10 years, are to introduce electronic data processing methods in pursuance of a policy of centralising taxation accounting for the whole republic of Eire.

The Commissioners have ordered an ICT 1301 computer to implement this policy.

Stocks computed

System helps AP report

Associated Press, the American news agency, announced that they would install in New York a computer system for preparing tabulations of stock prices and for transmitting these ' stock tables ' to subscribing news media.

The hub of the system will comprise two IBM 1620 computers—small scientific machines which cost approximately £30,000 each—and a 1405 disc storage file with capacity for 10 million characters.

The new system will permit Associated Press to transmit com-

pletely updated stock tables across the USA seven times daily from the New York and American Stock Exchanges and the New York Bond Exchange, and three times daily from the Midwestern Stock Exchange.

Trading in stocks will be reported to the Associated Press office by ticker tape and read at a speed of 10,000 words per minute by two IBM 1011 paper tape readers, simultaneously converted to machine code and fed into the computer system. The system will instantly update the status of each stock in the random access 1405 disc file, regardless of the sequence in which information is received.

Simultaneously, the 1620 computers will arrange the format of each newspaper line ultimately to be printed, calculate each stock's net change to date and compute highs and lows where necessary.

Three specially developed IBM paper tape punching units will transmit tables at some 4,500 words per minute in Teletypesetter code for input directly into newspapers' automatic line casting machines just before their press runs. The tables will also be transmitted in regular Teletype form for setting by conventional typesetting machines.

One of the systems will also be used to up-date the master stock list with additions and deletions, dividend and rights information and cumulative dividend payments. The entire job can be completed in less than ten minutes. Other stock information, including an index of key and active issues, will also be accumulated for use by various newspapers.

The new system is scheduled to go into operation in 1962.

Cheque Sorter Order

National Provincial join the others

The National Provincial Bank have arranged to rent from ICT document handling equipment worth some £85,000. The equipment comprises a 'document processor' and an audit lister, though document encoders for printing characters in magnetic ink will also be required eventually.

The document processor—basically a sorting machine with 18 receiving pockets—reads and sorts cheques at a rate of 1,200 a minute. The audit lister, which will be linked to the processor, provides the means for accumulating, proving and printing information read from documents in the processor; it features a printer capable of printing 1,200 lines a minute, and an arithmetic unit.

In ordering this equipment, National Provincial are following the lead given by other banks: in January this year Barclays Bank ordered an IBM 1210 document reader-sorter machine, and in March, Westminster Bank ordered a National-Pitney Bowes machine; Lloyds Bank also have equivalent equipment on order.

Although National Provincial are to rent their document processor from ICT, the makers of the equipment are, in fact, the National Data Processing Corporation of Dallas, USA. ICT concluded a long-term marketing and manufacturing agreement earlier this year, whereby ICT act as agents in Britain for the American company's bank automation equipment.

Commercial Pacts

RCA love everyone

ICT announced recently that they had signed an agreement with the Radio Corporation of America for the 'non-exclusive' exchange of technical information and patents in the field of data processing. RCA, who first embarked on research into electronic data processing in 1949, and were awarded a military contract to build a large-scale computer two years later, already occupy a strong position in the American computer industry and build highly regarded machines, so much so that English Electric made arrangements some time ago to manufacture an RCA computer in Britain—the KDP 10 is, in fact, a precise copy of the RCA 501 system, though, of course, built with British components.

RCA seem willing to make friends with everyone: at the same time as the ICT-RCA agreement was announced, the French organisation, Compagnie des Machines Bull, revealed they too had drawn up an agreement with RCA for 'exchanging information'—though, in this instance, what Bull got out of their agreement became instantly clear. Bull (and their British associates, De La Rue Bull Machines Ltd) are to market a new medium size computer—the Gamma 30—which is, in fact, an adaptation of another RCA computer, the RCA 301.

The Gamma 30 comprises a central processor with a ferrite-core store (with a capacity for between 10,000 and 20,000 alphanumeric characters) and capable of carrying out the four arithmetic functions (5-digit numbers can be added in 0·2 milliseconds). The Gamma 30 can be equipped with high-speed magnetic tape units (reading and writing speeds are of the order of 7,500 characters a second), and card readers (reading at 600 cards a minute), card punches (punching at 100 or 200 cards a minute) and paper tape readers and punches. In addition, it can be linked to an Analex printer (capable of hitting out 1,000 lines a minute) and to novel magnetic disc units.

(The Gamma 30 disc unit has 128 discs, each capable of holding 36,000 alphanumeric characters, so that the total capacity of a unit is 4,600,000 characters. Though the average access time to a single disc is not fast, once a disc is 'located' characters may be transferred at the rate of 2,500 characters a second.)

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Briefer Notes

Remington Rand are to establish a Univac computer office in Manchester. A USS 80 machine is to be delivered some time this month and is expected to be operational by early 1962. Initially the computer will be used for demonstration and training only.

National Cash are also going to set up a provincial computer centre—Dundee—but it is not clear what machine the centre is to have.

A 'telecommunications division' has been formed by Ultra Electronics, which is to be headed by Major General E S Cole, CB, CBE, formerly Director of Telecommunications at the War Office. Ultra recently acquired W S Electronics Ltd, specialists in VHF/UHF communications.

A 'programming systems division' has been set up by Honeywell Controls Ltd to design and develop automatic programming systems for Honeywell computers.

Pitney-Bowes Ltd have taken over the marketing and servicing of addressing machine equipment previously marketed by Underwood Business Machines Ltd.

IBM have experienced some difficulties with their new 3000 Series punched card accounting machines and recently put out the following statement: 'Although we tested these machines extensively before starting production, the result with the first machines installed is that they do not meet required standards for performance or reliability. We have decided that, before proceeding with any further shipments, it is necessary to undertake a programme in engineering redesign on the read-feed unit of the machine.'

'Until we have completed this programme and have been able to test such redesigned machines in our laboratories under customer use conditions, we cannot be certain of the availability of this equipment or when shipment might be resumed. We estimate, however, that this programme will take approximately 18 to 24 months.'

The 'computer applications section' of BISRA's Operational Research department has been renamed the 'systems evaluation section'. The duties of the section, which is to be headed by Mr D H Kelly, will be to carry out OR investigations into the automation of large-scale systems.

Two orders for the new ICT 558 40-column punched card computer were booked during the Business Efficiency Exhibition. Smart Weston Kingsland Menswear Ltd, the clothing and hosiery retail chain (with 50 branches) will spend £32,000 on their system. The Thames Board Mills Ltd are the second company on the 558 order book.

'You see, my wife doesn't understand my computer!'

THE REMOTE CENTRE

WHILE the concept of transmitting information between remote stations and a central computer is considered in the future, rather than the present tense, a privately-owned computer service bureau operating largely on programs and data transmitted to it from remote points has been working for almost two years now. As might be expected, the company that runs this bureau is a large one—Imperial Chemical Industries. The number of data links in the network is rather more than 60, and it is reckoned that by the end of the year, when the

the decision takers...the computer-minded

A business lives—or dies—by decisions. More and more, successful decision-takers are turning to the speed, the accuracy of computers. Slashed costs, decreased wastage, higher output, greater profit, all flow from computer use . . . but *which* computer? Your needs may be for a full-scale system, a small machine, five minutes at the Computer Centre—or perhaps a computer is not the answer at all. Pioneers in computer development, Ferranti can give you the benefit of their experience—and if you choose a computer, undertake its installation.

And Ferranti offer a wider range of computers, programs, training facilities and services than any other company. Current Ferranti activities include Nebula (Natural Electronic Business Languag· for commercial programming), Orion (revolutionary "second generation" computer) and Atlas (most advanced super-speed computer in the world).

PERMANENT WAYS British Railways have made a new senior appointment — a Ferranti Sirius computer to calculate incentive bonuses for six hundred track repair gangs in 5 Midland Region districts. Weekly repair analysis is an extra duty Sirius takes in its stride. Small, economical, very adaptable—that's Sirius.

AIRWAYS The wide blue yonder becomes more congested every flying hour — making traffic control over the Atlantic an ever-increasing nightmare. The Ministry of Aviation asked Ferranti for help; result, Apollo—a new computer at Prestwick Airport designed to bring a skyful of planes to happy landings.

ROADWAYS Road designers Maunsell and Partners took their Hammersmith Flyover problems to a Ferranti computer centre—hired time on a Pegasus and completed weeks of development work in minutes. Maunsells are engineers not computer experts—but Ferranti autocodes allow anyone to use a computer.

FERRANTI *RANGE OF COMPUTER SYSTEMS*

London Computer Centres : 68 Newman St. London W.1. (Museum 5040) and 21 Portland Place, London W.1. (Langham 9211)
Works : West Gorton, Manchester 12 (East 1301)

bureau will be two years old, it will have run more than 1,000 programs for the various divisions of ICI, and for a number of outside firms who participate in the service.

The bureau was started initially as part of the Central Instrument Laboratory of ICI at Wilton Works, near Middlesbrough. The department had just taken delivery of a Ferranti Mercury, a medium sized computer in the £110,000 price bracket, which is equipped with 1,024 words of magnetic core store with a cycle time of 10 microseconds, magnetic drum storage (two drums) and tape units (three). The important thing, as far as the service bureau was concerned, however, was the existence of an autocode for writing programs in. This meant that programs could be written, not necessarily by full-time programmers, anywhere in the twelve ICI divisions, and transmitted to the computer bureau for handling. It is on this basic concept that the service has been built up.

Interconnecting all the divisions—and many departments—of ICI is a direct dialling private teleprinter system. Programs and related data, punched on to 5-channel paper tape, can be transmitted to the computer centre from any of the 60 outstations of the system, received by the computer centre in paper tape form, fed to the Mercury, processed, and the results re-transmitted to the outstation in about 15 minutes. This, of course, would be a top priority job; normally, the aim is to return results by 9 am. on the day following receipt of data for a job.

Though the computer centre has a staff of about 40, not more than 10 of these are programmers. This is because it is axiomatic that the programs shall be written at the point of origin, where the particular calculation or statistic is required. This ' amateur ' programming is made possible by using the Mercury autocode. This method of programming, which has been compared to algebra, consists in converting the various instructions of the program into a series of algebraic formulae and equations. All ICI staff likely to be involved with the computer are given a week's training in autocode instruction, but it is possible to become proficient in writing programs after only a couple of days of serious concentration. A program written at the outstation and transmitted to the computer bureau, is subjected to a special diagnostic testing program, and debugged. The approved program can then be run, with the data, and the results returned to the originator.

Not all programs are handled by the data transmission network; some are too long for the relatively slow-speed data link, and it is more convenient and economic to send the program and data by post; in certain cases the data and the program would be offered to the computer on a reel of magnetic tape sent by post. But, despite these physical limitations, the computer staff reckon to handle an average of 50 jobs—or ' exercises', as they call them—in the course of a day's work.

Firms in the Middlesbrough area also use the facilities of the ICI centre for their calculations. They, too, make use of data transmission facilities, using the GPO ordinary telex network and private lines rented from the GPO. In all, about 80 different people use the centre every month.

The centre was designed to handle the scientific calculations of the various divisions of ICI, and such calculations comprise the bulk of their work. However, the bureau also does a certain amount of work for the O and M departments of the various divisions, in office organisation and optimisations, and also a great deal of the routine costing of new plant and equipment for the costing sections.

Continued on page 33

Correspondence

SIR:

As Aunt Sally in the discussion on random access versus serial access, may I have the privilege of answering one or two points made by the protagonists of serial processing. It was only when I saw the remarks of my fellow contributors that I realised that because of space limitations, some of my statements may have seemed a little cryptic.

Firstly, Mr Land takes me to task on my figure of 6,000 postings over 150,000 accounts, considering such a job to be an accounting machine function. If this were in fact simple posting he might be right; but I was naturally assuming an integrated data processing system where these postings would produce, for example, 6,000 invoices calculated in varying degrees of length and complexity. Hardly an accounting machine job! Had I used the word ' accesses ' instead of postings, it would have been less confusing.

Secondly, Mr Land refers to the possibility of holding a complete program in the working store. In medium-priced computers this is most unlikely to be achieved with other than extremely simple jobs. Because of its serial requirements, tape is completely unsuitable for holding overlay programs, and this situation may result in the use of drum stores, giving a three-level storage situation with all the associated problems.

Lastly, on the question of ' father and son ' techniques I would stress that although random access systems do not necessarily use this method, there are other equally effective methods of rescue and recovery. The ability to re-create a record at any point in time must be a basic necessity of any computer system, random or serial. Tapes use the ' father and son ' technique only because *there is no other method available to them.*

Mr Ziman notes that I qualified my statement regarding the comparative speeds of random access systems and magnetic tape systems with the words ' in Britain '. This simply means I am not familiar with all the tape systems in, for example, the USA. I based my statement on the fact that my own company's Cram system has a transfer rate of 150,000 digits per second and I know of no computer currently on offer in this country with as fast a tape speed.

Finally, I thank Mr Ziman for his very adequate summing up of the situation. As he so rightly says, there is a place for both random and serial access in all data processing systems. It follows therefore that to limit yourself to a system that does not possess both facilities can only add an unnecessary handicap.

Yours etc,

J CROWNSHAW,

London, NW1.

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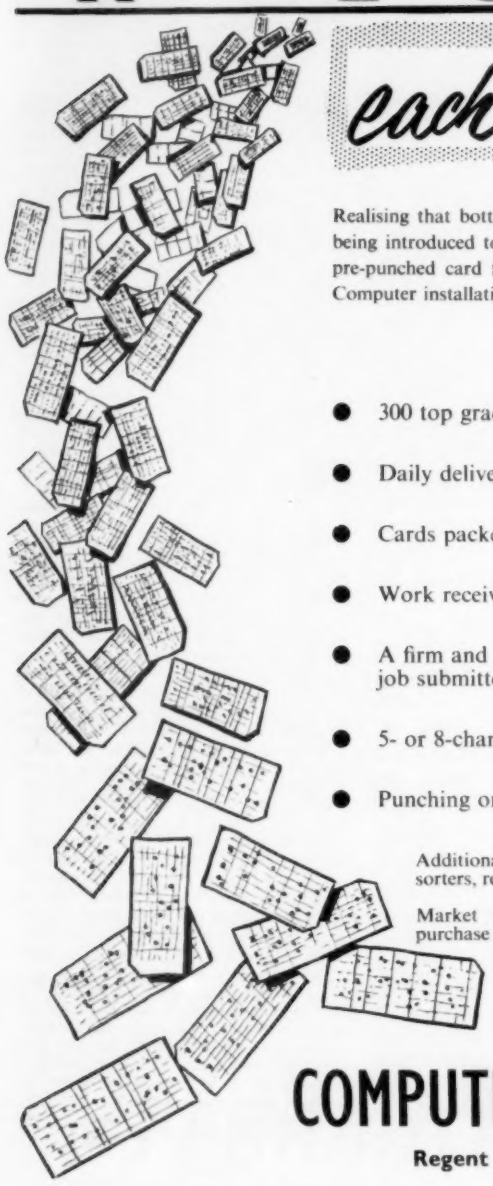

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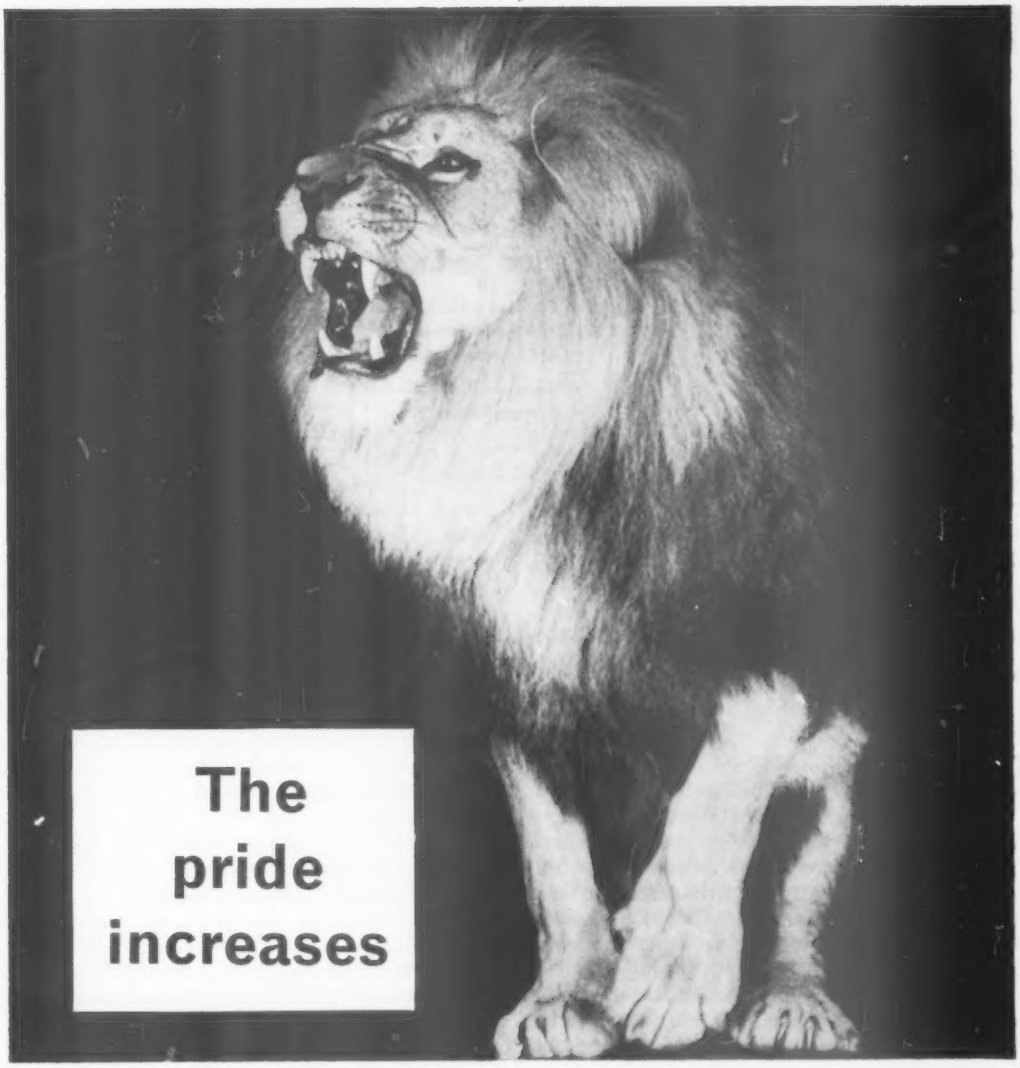

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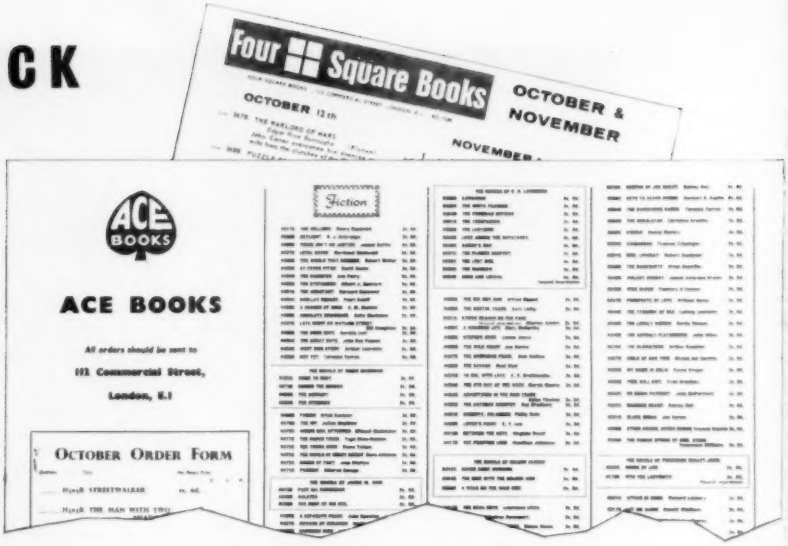

Alexander Seymour

Selling seven million books a year can become problematic when you want to service customer accounts and keep tabs on what is selling where

WHEN an old established firm goes into an entirely new line of business it can expect to encounter problems of marketing, accounting and production which are different from anything that it has previously had to overcome. But for Godfrey Phillips, tobacco manufacturers, who market Four Square tobacco, Abdulla cigarettes and other well-known tobacco products, the main problem was success.

In 1957, Godfrey Phillips decided to diversify their activities. One of the fields which seemed to offer great possibilities was the sale of successful novels as paperbacks. A provisional list of titles, ranging from war and crime books to Dostoevsky and Kingsley Amis was brought out, under the name of Four Square Books. This enterprise proved a gold-mine; by 1960, only three years later, there were more than 300 Four Square titles. With the acquisition of a second paperback series, Ace Books, with much the same range and roughly the same number of titles, Godfrey Phillips found that they had captured 10 percent of the paperback market, and that they were selling about seven million books per year. Since there were some 50 paperback publishers, of which the biggest and pioneer of them all had 35 percent of the market, this was quite an achievement.

By September, 1960, Four Square were handling orders and producing invoices at the rate of 250 a day. With the acquisition of Ace Books this figure rose to about 500 a day. It was estimated that with the consolidation of the two publishing ventures and certain other developments that were afoot (Godfrey Phillips are to market a number of titles published by an American company) eventually there might be between 750 and 1,000 invoices to despatch each day.

In the wake of this expansion went the problems of handling customer records for the group's 10,000 customers, updating stock records, issuing monthly statements, and preparing monthly sales statistics.

Phillips had not reckoned on an expansion of this kind. When the book division had been started, it was reckoned that the existing procedures—the typing of invoices, ledger preparation on an Elliott-Fisher, statistics prepared on a small 35-column tabulator—would be able to cope with the flow of orders. By September, 1960, it was clear that both the typing pool and the punched card system would be overloaded, and that there were just not the staff on the market to allow for expansion of typing to meet demand. The punched card system, too, was not really suitable for the job it had to do; the number of cards produced became unmanageable.

After looking at various semi-manual, semi-mechanical and electro-mechanical systems, which were turned down because they were too slow, required too many manual operations, or required too much modification, Godfrey Phillips came round, almost without their volition to considering a computer as the answer to their problems. After a

whirlwind window shopping tour of the machines offered by the various manufacturers, they settled on National-Elliott's 803. They chose this machine in part because delivery was promised within six months, and the manufacturers undertook to train staff and help write the programs so that the computer could 'go on the air' within the specified period. Because of the merger and the American link-up, it was essential that the system should be operative by the time the consolidation took place. The order was signed in October, 1960, just a month after the first consideration of the computer was bruited.

Within a week the first of Godfrey Phillips' chosen staff were attending programming courses at Elliott's factory at Boreham Wood. By January, 1961, the first programs for the 803 were begun, masterminded by John Gilmour of Godfrey Phillips, a former member of the Army Operational Research Unit, and Tom Chellew of National, who later joined Godfrey Phillips as chief programmer.

The computer was delivered—somewhat behind schedule—in August, 1961, into the special office built for it on the first floor of the Godfrey Phillips building in Commercial Street, London, E1.

WHAT IT DOES

At present the work done on the company's machine falls into two categories: daily invoicing and updating work and monthly operations.

Daily some 500 orders are received and processed; once the information on the orders have been transferred to paper tape, the computer updates customer accounts stored on magnetic film, produces invoices or credit notes (for books can be returned as well as ordered) and updated stock figures.

Monthly operations involve producing statements for every customer, according to his particular billing method, and statistical records and analyses of sales by title. A monthly check is also made of 'future titles'—books not yet published for which orders have been taken in advance.

The company send out monthly stock title sheets to their 10,000 customers on which are printed all the books in stock with title, author and book code number. The retailer (or wholesaler) has then merely to mark against the title the number of books he requires, and enter his name and address, the date and his code number. The same procedure is followed for 'future titles': some months before printing, lists of books to be published are sent out, and advance orders give Godfrey Phillips an idea of the market for the new books as well as a realistic basis on which to make a print order.

The first operation of the daily invoicing and updating run is a manual one: transferring information on orders (which have first been sorted into customer number sequence) to paper tape. Punch operators produce tapes containing customer numbers and the quantities and code numbers of books required. Also entered are the postage required for each order and the date each account matures.

The company keep their title record files—the records of available stocks of books—on magnetic film, and the next step in the daily procedure is to transfer the contents of all the title record files to the computer's core store so that access to any particular record is immediate. The title records comprise the number and title of each book, the original print order, the total of stocks held, total sales to date for each book and the total of returns.

Also kept on magnetic film are the details about each customer. These comprise such static details as his name, address (in some cases invoicing and delivery addresses), the type of outlet he is, his credit rating and discount terms, and the number of the representative serving him. In addition, variable information relating to the customer is also recorded: his credit balance, the details of his

The Godfrey Phillips computer consists of a central processing unit with a 4,096-word core store and three magnetic film units—one used as a standby—each with capacity for 4,096 blocks of information, each block being comprised of 64 words. Input is by 5-channel paper tape via an Elliott high-speed reader (reading at 250 characters per second) and output is via a Teletype punch, punching 5-channel tape at 100 characters per second. The tape is then put on to two interpreting teleprinters, with a third teleprinter as a standby and is printed out at 10 characters per second. Two reproducing teleprinters, one acting as a monitoring teleprinter during the course of the operation, and the second acting as an on-line reproducer make up the printing out complex. The tape preparation media are at present two Creed punches and two verifiers. The total cost of the equipment complex is about £50,000.

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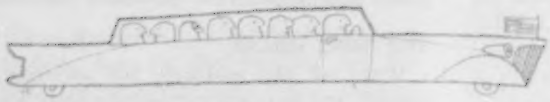


AMERICAN REPORT

from John Diebold and Associates, New York

Extending Man's Intellect

Computer techniques are being developed which will widen man's understanding—not merely of computer technology, but of how the human mind works, its processes and limitations, and at what point machines can 'imitate' human activity.

'THE REVOLUTIONARY IMPACT OF THE electronic computer on our society may well be equal to that of atomic energy—and may actually surpass it in the long run'—this was one prediction made during the opening session of the Western Joint Computer Conference held earlier this year* in Los Angeles.

However, the theme of the conference—'Extending Man's Intellect'—suggested that the 'revolutionary' aspect of computer science is more than a technological and material one. Computer science is now entering the realm of intelligence or, at least, mentality.

Of the 58 papers presented in the conference's manual of proceedings†, several were written by psychologists and other specialists in various social sciences—an indication of the interdisciplinary nature of computer sciences.

Such topics as digital simulation, modeling human mental processes, problem solving and learning machines, information retrieval, and automata theory and neural models were discussed. In fact, though several sections of the conferences were, of course, devoted to pure technological presentations, the trend toward computers having 'intellectual' abilities was clearly the dominant chord of the conference.

DIGITAL SIMULATION

There were some colourful observations: 'a direct consequence of the computer', Harry H Harmon of the System Development Corporation of California, noted, 'is the burgeoning activity which collectively goes under the name "simulation". The growing awareness and popularity of this field of activity is evidenced by a recent article in *Business Week*, in which a parallel is drawn between the group of simulation experts and the group of painters known as the Futurists.

' Just as the art works might bear no direct resemblance to the objects for which they were named, so the mathematical formulas, flow diagrams, and computer outputs bear no direct resemblance to the world which they simulate. Moreover, this symbolic art " represents a massive assault on tradition—in this case, the traditional art of managing large organisations".

' Perhaps the simplest and more direct definition of simulation,' Mr Harmon suggested, ' is merely the *act of representing some aspects of the real world by numbers or other symbols that can be easily manipulated.*'

Accentuating the use of simulation as a research

* This report was held over from last month's issue to accommodate a preview of the Electronic Computer Exhibition. The Western Joint Computer Conference (it also has a counterpart, the Eastern Joint Computer Conference) is an annual conclave in the USA at which the most advanced thinking in computer technology is presented.

† Copies of the 661 page volume of conference papers occasioned by the 1961 WJCC may be obtained from any of the sponsoring societies, at $4.00 per copy: Institute of Radio Engineers, One East 79th Street, New York 21, New York; American Institute of Electrical Engineers, 33 West 39th Street, New York 18, New York; and Association for Computing Machinery, Two East 63rd Street, New York 21, New York.

tool, Mr Harmon briefly described such applications as operational gaming, management control, social control, and road traffic control. Definitive studies of these uses were presented by Joel Kibbee of Remington Rand and Andrew Vazzonyi of Ramo Wooldridge.

'Management games', Mr Kibbee observed, '... are primarily of concern to the educator and to the research scientist, but since many of these games are played with the aid of an electronic computer, they should be of interest to computer people in general.' He pointed out several uses for games including one in which each manager controls an entire business operation and the 'winner' is the one who finished with the largest accumulated net profit. The technique is to throw the executives, into a situation and make them organise, delegate, decide, etc.

Asked whether any games exist for training teachers or programmers Mr Kibbee mentioned the Steps game the Systems Development Corporation, 'which is used to train supervisors of programmers but not to teach the technique of programming itself.'

Mr Vazzonyi described a non-line management system, a management decision game, designed to train executives in the planning and control of large-scale research development and production programs.

Aaron Glickstein and S L Levy of the Midwest Research Institute then described a general digital simulation model, 'which can duplicate traffic flow on a 17,000 foot section of freeway, including two on-ramps and two off-ramps, and can be used to economically evaluate alternate design criteria.' The simulation allows planners not only to evaluate without first building a freeway, but it also allows them to perform experiments impossible to perform with actual traffic.

M A Geisler and W A Steger of the Rand Corporation described simulation for the development of a military weapons system.

MODELLING HUMAN MENTAL PROCESSES

Delivering the opening paper of this session, Herbert A Simon, also of the Rand Corporation stated, 'There now exist at least a half dozen computer programs that simulate some of the mental processes that humans use to perform problem-solving, learning, perceiving, and thinking tasks.'

The goal in this type of simulation, Mr Simon stated, is to obtain understanding of the human mind by imitating it. He noted four categories of mental simulation:

> (1) Abstract simulation of adaptive, goal-seeking, learning mechanisms, in order to understand the nature of organisms in general, rather than the human organism in particular.
> (2) Simulation of the sensory-perceptual processes by which humans recognize visual and aural patterns and symbols, in order to ascertain the cues that humans use to recognise the basic phonetic units of spoken language. Partial successes have been recognised in this attempt.
> (3) Simulation of the self-organising capabilities of neural nets, in order to determine how the patterns mentioned in category two are acquired by the nervous system.
> (4) Simulation of the symbol-manipulating or information processes employed in learning by rote, in attaining concepts, and in solving problems, in order to form an information processing theory of human mental processes.

In discussing the long-range goals of simulation, Mr Simon states: 'Perhaps the largest single gap at present—and one that is not filled by any of the work to be reported today—is in programs to explain long range human memory phenomena. I will venture the personal prediction that filling this gap will soon become crucial to progress in the whole field of information retrieval.'

E A Feigenbaum of the University of California then discussed the computer program called 'Elementary Perceiver and Memorizer' (acronominally designated as EPAM), which simulates the behaviour of subjects in experiments involving the rote learning of nonsense syllables, and which attempts to state quite precisely 'a parsimonious and plausible mechanism sufficient to account for the rote learning of nonsense syllables.'

These simulations, he pointed out, are models of human mental *processes* and not mental structure. They are purely psychological models. They conceive of the brain as being an information processor, capable of doing only one (or very few) things at a time.

Julian Feldman of the University of California then described a modern high-speed digital computer, used 'to simulate the behaviour of individual human subjects in a classical psychological experiment where the subject is asked to predict a series of binary events'.

In the final paper of the session Earl B Hunt and Carl I Hovland of Yale University discussed a model of human information processing, which has been constructed, and which uses a list processing, digital computer program. 'The program's input consists of descriptions of objects in terms of dimensions and values. The universe of objects is divided into two or more sets, and the program attempts to form a decision rule, based on the descriptions of the objects, which can be used to assign any previously presented or new object to its correct set.'

SOLVING AND LEARNING MACHINES

'Work on artificial intelligence', Marvin Minsky of the Massachusetts Institute of Technology reported, 'is proceeding at a slow, apparently steady, rate.... In the past it seems to have taken two or three years for each significant advance.' Mr Minsky's explanation of this slowness is, first, that much time has been required for the develop-

ment of programming languages and systems suitable for the symbol manipulation processes involved, and, second, that the methods which worked quite well for simple problems were not adequate for the more complex ones. As problems become more complex, he stated, we cannot afford a complete trial and error system. The search is so difficult and so costly that total failure cannot be allowed. With simple problems, such as playing tic-tac-toe, it is practical to try a number of methods, discarding those which are inadequate. With extremely complex problems, the searching must be done systematically and expensive experiments must be very carefully designed. Minsky feels that internal language processing is an urgent need, but that little progress has been made in this area to date.

A team from MIT's Lincoln Laboratory described a fascinating question-answering program called ' Baseball '. The program answers questions phrased in ordinary English about stored data. The program reads the question from punched cards, looks up the words and idioms in a dictionary, determines phrase structure and other syntactical facts for content analysis, extracts the requested information from the specified data, and, finally, prints the answer.

' Baseball ' is the first step toward enabling men to communicate with computers in natural language.

The final paper in the session, presented by John McCarthy of the MIT Computation Center, was a preliminary report on the development of a mathematical science of computation which, it is hoped, will overcome the chief limitation on what we have been able to make computers do so far—this limitation, Mr McCarthy feels, is our own weakness as programmers.

INFORMATION RETRIEVAL

Progress in information retrieval was reported by Don R Swanson, and M M Kessler of MIT's Lincoln Laboratory, and Robert T Moore of the National Bureau of Standards.

Mr Swanson pointed out that automatic abstracting of information is still an unsolved problem—and a critical one. No rules have been formulated which are better than ' select title and first sentence of each paragraph '. It is desirable to cut the size of a text drastically without an accompanying loss of information. To date, however, such an accomplishment has not been successfully demonstrated.

Mr Kessler's report pointed out that definite patterns do exist for the flow of technical information. ' Quantitative data are presented on the flow of information between cultural and functional groups, and between past and present. An analysis of the numerical data indicates that these flow patterns are deeply rooted in the dynamics and evolution of scientific thought and engineering development. The analysis also discloses that extreme asymmetry exists between journals in their capacity as carriers of scientific information.'

Proposing one possible solution to the problems faced by large information retrieval systems, Mr Moore described a screening method for reducing the excessive processing times often encountered now. Two tools are suggested for this method: ' (1) a screening system to allow multi-level processing of material and (2) pre-processing of the files to allow block rejection of documents not answering a retrieval request.' Thus far this system had only been tested theoretically, but, Mr Moore assured, success was promising enough to warrant detailed testing of real files.

AUTOMATA THEORY AND NEURAL MODELS

W Ross Ashby of the University of Illinois produced the coldly realistic statement that, contrary to traditional belief, the human brain is not unlimited. It has, in fact, the same limitations as does a computer. ' Man and computer show their powers alike, by appropriate selection. But both are bounded by the fact that appropriate selection (to a degree better than chance) can be achieved only as a consequence of information received and processed. Machines can be made as intelligent as we please, but both they and man are bounded by the fact that their intelligence cannot exceed their powers of receiving and processing information.'

H D Block of Cornell University then gave an introduction to *perceptrons*—the self-organising or adaptive systems proposed by Frank Rosenblatt as greatly simplified models for biological brains, whose main objective is to explain how the brain performs its functions in terms of its structural components. Murray L Babcock the University of Illinois then discussed the physiology of automata.

In addition to these sessions briefly described, the conference had sessions in microsystems electronics, progress in computer circuit design, new hybrid analogue-digital techniques, automatic programming, memory devices and components, applied analogue techniques, pattern recognition, and computers in control.

Perhaps the chief significance of the conference was the exposure it gave to the increasing concern with computers for intelligence purposes. The conferences gave a preview of many advanced systems that we can expect in the not-too-distant future; it showed a new interest in computers being shown by psychologists and biochemists—people who, in the past, have been largely divorced from computer technology; and, finally, it revealed a strong trend toward computers being designed for total-systems purposes.

How Near is Machine Translation?

Since 1954 demonstrations of language translation by machine have been given occasionally by scientists, but the time when a machine will replace the translator or interpreter is still a long way off.

L A Steiner

ALL over the world there are computers waiting, as it were, for programs to be devised which will provide rapid and automatic translations from one language to another—waiting, in fact, for the results of research and experiments now being carried out by groups of programmers, philologists, mathematicians, lexicographers, system engineers and computer designers, which should produce these programs.

Some of the scientists engaged in this work, in fact 350 of them, gathered recently at the National Physical Laboratory at Teddington to listen to each other and to try to understand each other. A difficult task, because the language of 'machine translation' itself is new, created partly by the appearance of unexpected difficulties and partly by the fact that in the past most groups were working in isolation and talking largely only to themselves. The occasion was the first International Conference on Machine Translation and Applied Language Analysis, and contributions came—in order of volume—from the USA, Britain, France, Italy, Japan and the USSR.

PROBLEMS

The notion of translating languages by machine is not new; it was not even new in 1958, when the National Physical Laboratory organised a staggering conference on the 'Mechanisation of Thought Processes', so the fact that after three years little actual machine translation has been done indicates that there are problems to putting the notion into effect; a good part of the conference was, in fact, devoted to detailing these problems and outlining possible solutions.

Superficially, it might be thought that if it were possible to construct a large enough 'machine dictionary' within a computer so that words could be easily located and their equivalents in another language printed out, the matter could end there.

Such a dictionary might comprise 500,000 words, counting all inflections, declension and other forms in which a word may appear. Granted the expense of finding storage capacity for such a dictionary in a data processing machine, the processing of a single word would be no problem at all; but a combination of, say, 10 words in a sentence, which would preserve its meaning when transferred into another language, is still a formidable problem.

Many words have no exact equivalent in another language, and still more words depend for their precise meaning on neighbouring words, or on a wider context. The English word 'do' has several columns in any dictionary worthy of the name; the word 'out' can be an adverb, an adjective, a noun, an interjection, a transitive verb and, of course, a prefix. Indeed, the ambiguity of many words—*ie.* the fact that they have no fixed, singular meaning, and that the use of words developed in various languages differently, that the formation of sentences is subject to widely different rules and to exceptions from the rule when a machine can work to precise rules only—are the main problems of translation by machine. In addition, the machine has to find the rule which it is going to apply from the text presented to it.

The practical importance of finding a solution has induced an expenditure of two million dollars a year in the USA, provided mostly from Government funds,

and many of the problems are now being tackled from several directions.

THE SINGLE WORD

Economy in the size of the dictionary dictates, in many cases, as short an entry as possible, though a machine dictionary of full length words which occupies very little space, has been developed by IBM. It is, however, often useful to split off the ending of a word, chiefly of inflected Russian words, to enter the remaining stem in the dictionary and to use the split-off portion for interpretation. Many chemical terms can be broken up into fractions and re-built in the other language in the same or in a different order. There was a suggestion made to use the length of the word as a feature by which it can be recognised.

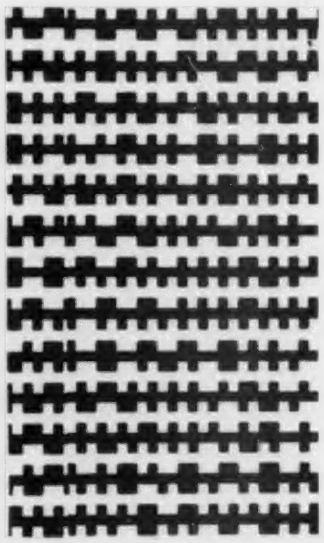
The effect of the article (definite 'the', indefinite 'a' and no article) on the meaning of the word and of the sentence was well demonstrated and discussed during the conference. The importance of such study is obvious, if one considers that Russian has no articles and the problem is how to avoid ambiguities when a sentence is transferred into a language which depends on the article for definition. All these and other suggestions are directed towards obtaining from the form of the word as much information as possible and to arrange the sequence of the entry in the directory in a most economical manner. A machine dictionary, if printed out would, therefore, differ completely from the normal book form.

A machine dictionary, it appears, must have attached to its entries also all the information available of the possible application of the entered fragments of words, of complete words or of combination of words. Translation on a large scale could be considered only after the additional information as to the possible application of an entry is available.

However, before programs can be written for a machine to construct a sentence from the stored fragments, the programmer must know all about the structure of a sentence, both in the source language and in the target language. The study of syntactic structure should precede syntactic programming; 18 papers, half of the total, were specifically devoted to this problem, ranging from abstract studies of syntax to the use of special-purpose computers.

Attempts are being made to predict what words may follow each other and also to reduce the physical distance of words in a sentence in order to make a sentence more amenable to 'processing' by machine. How to reduce the effect of multiple meaning, how to write a program for the most plausible structure and the creation of a new, purely machine language, were other considerations presented at the conference.

To construct a sentence just by collecting a few words and giving them instructions by machine to combine themselves under given rules (just like telling a child what it may and may not do) is one of the methods which were tried in order to gain insight into sentence construction. Grammars which are pure invention, *ie.* based on symbols only, were also studied.



Coded tracks (magnified 300 times) of Russian-English machine dictionary, stored on part of 10 inch glass disc.

A proposed procedure for the automatic translation of Japanese into English, turned out to be an attractive variant of that from Russian into English. In the latter an attempt is being made to predict from the beginning of a sentence what may follow, while in translating from Japanese the last word in a sentence is taken first.

Human translation, as opposed to machine translation, was the subject of two papers from Milan, stressing the essential difference between the two techniques.

US CONTRIBUTION

The contributions of authors from the United States was formidable by all standards: 23 out of 37 papers came from USA, originating from Harvard, MIT, the Universities of California, Georgetown and Wayne, the NBS, the Rand Corporation, IBM, Lockheed, Ramo-Woolridge and the Air Force. Such wealth of knowledge and research was bound to make a great impression. In the past, Harvard went to great length to provide the National Physical Laboratory with their dictionary, and the willingness with which help and information was offered should be acknowledged. US Government funds support a number of research groups abroad.

Italy and France have contributed three papers each. These comprised a treatise on the role of the definite and indefinite article and papers on the comparison between human translation and transfer by machine, these opposing 'soul' against 'machine'.

Japan and USSR each contributed one paper. The first was an attempt to create a universally applicable syntax, the second—not available in print yet—on

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Punched Cards are Key to Manufacturing Control

TV aerial makers Belling and Lee have a production control problem of many parts — some 12,000 of them. They handle the inter-related tasks of production programme breakdown, machine loading and outside purchases of parts for their two factories with a punched card equipment complex

ONE of the first instances of the use of electronic data processing equipment to provide control over production is to be found with Belling and Lee Ltd at Enfield, Middlesex, where an integrated system of stock and production control (which includes machine loading by type of machine) has been running for over two years.

Belling and Lee manufacture television aerials and their components as well as high quality components for electronic, nuclear and other special applications. At their factories in Enfield, and Liverpool some 1,100 people are employed. Some 1,000 different components are manufactured at Enfield and about 400 different aerials and accessories at Liverpool. A further 250 items are manufactured by other small divisions at Enfield.

In all, the total number of production stock items to be controlled exceeds 12,000. This figure includes finished goods, parts and raw materials.

The Liverpool factory produces about 400 different lines which include masts, clamps, aerials and lashings as separate items. Any of these lines might comprise sub-assemblies and/or piece parts. One complication lies in the common application of sub-assemblies and piece parts to any level, *ie.* list lines, sub-assemblies, etc, with a varied 'number off' throughout the breakdown. In these 'list items' there are over 300 sub-assemblies, some 300 sub-sub-assemblies, over 1,500 piece parts and 500 packing items such as cartons and labels. The operation is further complicated as, at each level, stock figures have to be introduced to make the breakdown from sub-assemblies to piece parts a true one. Of the sub-assemblies and piece parts, about 1,000 use a raw material purchased outside, the requirements for which have to be calculated in the appropriate unit of measure.

Such is the nature of the problem. Formerly it took three men, working by manual methods, three weeks to work out a breakdown of parts requirements resulting from a change in the sales forecast.

This was not an adequate system since, from these breakdowns, orders were placed for which, frequently quick deliveries were required. Attempts were made to plan in advance the loading of machines, but constant changes in the production programme made this impossible. Stocks kept getting out of balance due to machined parts awaiting the arrival of purchased-out items, and vice versa.

THE WORK TODAY

Today this same work including the components factory breakdown involving over 4,500 parts and materials is carried out in the IBM data processing installation at Enfield and is completed in hours. Stock holdings, as a result of more accurate forecasting of needs have been reduced by 22 percent in two years. Up to date 'work in progress' (WIP) and achievement reports for foremen, and exception reports for management, have brought tighter control over operations. The sum of operations now carried out on the equipment includes:

A production programme breakdown to parts, raw materials, packaging, etc.
Group machine loading
integrated stock control
Control of scrap and rejects
Comparisons between parts purchased and the requirements for each period.

To these operations can be added the company's nominal ledger accounting with an integrated cost and budget analysis involving over several separate reports. All of this work is at present carried out on an IBM 628/421 accounting complex —in effect, nothing more than a sophisticated punched card installation. IBM data transceivers, which allow information on punched cards to be sent over leased telephone line, so that cards are punched at the receiving end, connect the Liverpool and Enfield factories. A staff of 17 copes with the entire work.

FIRST STEPS

The first use of EDP equipment to solve the problems was made in 1957 when a breakdown of parts requirements was produced in 30 minutes on an IBM 650 computer in the IBM service centre in Wigmore Street, London. This breakdown was repeated at intervals and the resultant savings in the first few months amounted to several thousand pounds. Two points, however, emerged. The first was that a fully integrated stock control, with a full control of WIP and outstanding purchase orders was essential. The second was that the immediate use of a large computer was not economic since there were many intermediate steps to be taken which could be achieved with simpler electronic computing equipment. Belling and Lee's equipment was therefore rented from IBM with the idea that it could be turned in and replaced with more sophisticated machines if these became economically justifiable.

SALES FORECAST

A six-month sales forecast, based as follows, was considered an essential first step to devising a mechanised system of production control:

Month 1 Firm (no change)
Month 2 Limited changes
Month 3 Up to 25 percent changes
Month 4– to 6 Intelligent guesses

This forecast is now given by the management, and when it is received by the EDP department is used to produce a breakdown of parts requirements showing:

1. The six months requirements of the selling line.
2. The gross requirements for each level, lead time having been taken into account.
3. The net requirements for each level after WIP, actual stock plus free stock (which is scientifically calculated), is taken into account.

As a by-product of this work outstanding orders are examined to see whether delivery has in fact tied in with requirements. The whole of this operation (which requires a number of ' passes ' of the punched cards representing details of each part number and each level through the machine), takes one and a half days and is carried out every four weeks.

MACHINE LOADING

It did not seem practicable to Belling and Lee to attempt to plan loading for *individual* machines and therefore machine loading is confined to type of machine. Punched cards representing each part are used to produce a ' group machine loading programme ' showing the operation, its rate, the number off, and the hours needed. Copies of the table go to the foreman in charge of the shop and to the progress chaser, who in turn allocate the loading to individual machines. Every item in the shop and WIP is included in the machine loading, and the tables are produced within four hours of completing the breakdown of parts requirements.

As each operation is completed a record of the quantity produced, quantity passed, and of scrap and reject quantities, is printed by machine to give a *daily achievement report* of intermediate operations. This is ready each evening and shows the position of WIP at 3 pm. that afternoon. It is available for action by inspectors and production engineers first thing the next morning. Not only does this list allow the foreman and progress chaser to follow the programme: it has, in fact, virtually eliminated scrap since closer supervision became possible. At any time the whereabouts of a batch, the number and state of an operation, and the next stage of work can be ascertained.

STOCK CONTROL

A stock status report is printed every Monday showing the position at 3 pm. on the Friday before. A section of stock comprising 4,500 items, with stock movements involving 10,000 cards during a week, and making a total machine run of over 14,500 cards, takes two and a half hours on the 628/421 complex, and a further two hours preparatory work.

The stock status report shows for each stock item, WIP or outstanding orders, lead time, the weekly opening balance, receipts, issues, weekly closing balance, minimum and maximum free stock, stock below or above the minimum or maximum, the date of the last receipt and the date of the last issue.

A minor operation during the control of stock is the check that is kept on purchasing achievement. All orders are automatically checked against deliveries, and a report is printed which shows what has come in, quantity due, the quantity omitted, and its value.

LOGICAL DEVELOPMENT

The development of this installation continues, and the role of the EDP department is being increasingly valued by other departments in the company. The data processing manager—the man who has been largely responsible for the present efficiency of the work—describes its running as ' simplicity itself ', and says that production control, for all that may be said, is really a straightforward and logical operation. Certainly he has built up, without the use of a large and expensive computer an operation which could well be studied by others, and which, for Belling and Lee, is saving money and making the running of their factories more efficient.

JOB MARKET REPORT

DOES an advertisement with a gimmick pay off? English Electric have reason to think it does. Recently they advertised in the national press, using the following symbols:

KDF9
KDP10
DEUCE

CAREER

which, they stated, was a problem in conventional decimal addition. They invited readers to solve this problem, saying that if they could they should write to the company's Kidsgrove data processing division, who might have a job for them.

Nearly a thousand replies were received. A few people replied posing a problem in their turn:—my address is . . . . ; my age is . . . . etc; in mathematical logical code, but mostly the answers came from people who were interested in a career with English Electric. The company, who had a shrewd idea that this advertisement would hit the jackpot, had programmed a reply to the replies on the KDP 10 computer; the names and addresses were written on to magnetic film, and a standard reply was printed out on the computer printer.

Mr Mortimer, head of Personnel at English Electric, said that this response would condition the pattern of future ads. He knew in advance pretty well what the response to a particular ad would be; a conventional one brought in about 20–30 replies; an advertisement incorporating an original or striking theme might gross more than a hundred replies, but a potential winner, like this problem ad, could pick up from 500 to 1,000 replies.

* * *

There were seven OR vacancies last month, and they illustrate the great variety of work which this category embraces. Glacier Metal Co envisage building up an OR department in two years; the nucleus of this department is a Statistics Research Organiser who will supply a statistical service for the analysis of experiments. A man with experience, and a statistics degree or associate membership of the Incorporated Statisticians' Institute, would receive a salary of £950–£1,350.

By contrast the OR assistant required by the Co-operative Wholesale Society is to form an OR team which is part of the Organisation and Methods Department. Requirements for this man, who will be a mathematics graduate in the 21–25 age bracket, is the practical experience of the application of mathematics to commerce and industry, and determination to pioneer solution to complex problems. Bisra, who regularly advertise for OR men, are more specific; a senior OR analyst with three or four years' experience, though post graduate work in OR would also serve as experience; a graduate in mathematics, economics, engineering or science; able to lead a team, isolate and formulate problems, conduct and control analysis and to present verbal and written reports. Bisra provides an OR service to various steel manufacturers; a similar statistical and OR service is provided by the OR section of London Transport to the operating, engineering, commercial, research and other departments of the organisation. The head of service section, should have a professional qualification, with practical experience of applying statistical methods and OR techniques.

The other three OR vacancies concern the introduction of computing techniques; a senior mathematician is required to head the mathematical laboratory at the National Institute for Research in Nuclear Science, to direct operational and programming staff, install and operate an Atlas computer, plan the use of computer facilities, and sale of spare time—with a salary of £3,350 per annum as bait; Park Gate Iron and Steel Co require project staff—leaders and a manager—to study the optimisation production planning and process control techniques. Finally IBM ask for several OR men, among a clutch of other programming and planning staff, for work on the 7090 at the Data Centre.

* * *

There are signs that the consultants and marketing men in manufacturing companies are beginning to become more specialised. This may be as a result of setting up city centres, designed to capture a particular range of professional business, stockbrokers, unit trusts, insurance brokers, etc. Ferranti are advertising for senior staff

with experience of local administration and public service, and also for persons able to specialise industrial data processing; in another advertisement, they require analysts for transport, banking and stock control applications. Consultants Urwick Diebold recently advertised, on behalf of an unnamed computer manufacturer, for an insurance systems specialist, to advise users and potential users of the application of computers to all aspects of insurance. This man—whose salary range was not mentioned—should belong to the Chartered Insurance Institute or the Faculty of Actuaries Institute. However, the salary ceiling for consultants with another organisation is defined as being £4,000 per year at 40; since the consultant firm reckons to take on men around 30, with management experience in accounting, O and M, or production, this figure represents the expected salary of a man of ten years' experience in the consultancy field. £4,000 plus is also given as the salary offered by a computer manufacturer for a sales manager with *experience* (the advertiser's italics) of sales, service, design and manufacture of computers. However, a data processing manager for a city institution, with accounting experience, administrative ability and drive, understanding of mathematics and experience with punched card systems is offered only £1,500 (at the age of 30). Would a man of 30 have this ability—or, if he had, would he be willing to accept this money?

* * *

The market for programmers is brisk. The biggest advertiser over the September-October period was Ferranti, who advertised on five different occasions for five different types of programming staff. Ferranti (Manchester) required programmers with a degree and capable of writing diagnostic programs for Orion, and also to write performance programs to subject Orions to searching tests before and after delivery. Ferranti (Wythenshawe) wanted a programmer for their Wythenshawe Laboratories (degree standard, experience desirable, and knowledge of numerical analysis) for work in applying digital computers to process control. Ferranti (Bracknell) wanted programmers (and other staff) for work on special purpose data processing systems; such programmers need to have a degree or a HNC in engineering, physics or mathematics. Ferranti (Hollinwood) invited applications for experienced programmers to advise on the definition of specifications of Atlas systems to meet the needs of prospective customers. Finally, Ferranti (London) wanted programmers to design system programs—including input/output handling—for the Atlas at the Newman Street centre, plan applications and problem programs, and to compile automatic programming languages. The differentiation between these jobs seems to indicate the degree of specialisation which programming has now reached.

Apart from Ferranti's five, there were twenty-one vacancies for programmers. The breakdown of these were; four vacancies for chief programmers (including British Railways and Tube Investments) for a salary of £1,500–£2,000, four years' programming experience, leadership qualities, degree and also professional qualifications were requisite. Three senior programmers were required —by Ronson's central statistical department, though trainees were also invited to apply; by Harris Lebus—who have a 1401 on order; and by British Railways (Southern Section). The qualifications for a senior programmer were given as a science, maths or engineering degree, experience, and the ability to work with minimum supervision. Programmers/Systems Analysts grossed eight applications, from Stewarts and Lloyds (a Leo II), Milk Marketing Board, Albert Reed (a group computer service centre planned), Burroughs Wellcome (an ICT 1202), the Co-operative Wholesale Society, Rubery Owen (1202 and 1301 on order) and Beechams (an Orion). Qualifications varied, but a maths degree or advanced level, ability to discuss computer applications, ability to program and plan punched card operations, experience of numerical analysis, were among the desired and required talents. Only Beecham directly specified two years' experience; most of the others were prepared to accept people with experience and train them themselves. There were seven advertisements specifying simply 'programmers'. Among these canvassers were IBM (staff to develop Algol, Fortran, and Cobol), W D & H O Wills (to investigate, plan and program for two Leo II computers); Carreras (to work on an ICT 1202 and plan for a 1301); CAV Ltd (to join the Research Dept); Bristol Siddeley (to join a team working on four computers); and West Sussex County Council. The salary range when specified, varied between £1,000, £1,140 and £1,480.

* * *

The largest category of vacancies was, as always, for O & M investigators. In this month's batch of the 36 advertisements for O & M and systems analysts, half mentioned a knowledge of data processing, computers or punched card systems as being a desirable and, in some cases, an essential qualification. The salary scale for those vacancies varied from a low of £930 to a high of £2,000—a qualification in chartered accountancy being also specified in this case. In general, the salary range was between £1,000 and £1,500 and the age limit was specified at not less than 35, and usually between the age brackets 29–35. In almost every case possession of a degree or equivalent qualification was specified, and up to three years' experience was 'desirable'.

Keeping the Strip Rolling

'It monitors, checks, inspects, reports . . .'
In a Pensylvanian steelworks, as cold strip steel is fed to the furnaces at a rate of 2,000 feet per minute, heated, cooled, rolled, and coated with tin, a special computer control system tracks it through all the successive processes. It collects data for operational analysis, produces quality records, and even checks on its own actions.

Leo Walter

PRODUCTION and quality on one of the most modern continuous annealing lines in the US steel industry is being monitored and controlled by electronic computer. This is the annealing line of the Tin Plate Department of Jones and Laughlin Steel Corporation at Aliquippa, Pennsylvania, which is equipped with a 'digital control computer system' manufactured by the General Electric Co of America. It is claimed that this is the first continuous steel process to be subjected to computer control.

The annealing line heat-treats strip steel before it is coated with tin to form tin plate, the material manufacturers use to make tin-coated steel cans. It is claimed that the new system controls variables in the annealing process to achieve greater efficiency and a more uniform product. Its functions include data acquisition, production analysis, and accounting.

The system has in fact to carry out a number of complex operations, such as:

1. to plot a method of operation whereby the continuous annealing line can be run at its most efficient speed and with the greatest product quality without abuse of the equipment.

2. to provide 'instant' accounting records on punched tape for each coil of steel as it emerges from the line.

3. to reduce furnace down-time by checking the various sensory devices within the furnace for off-normal practices or conditions.

4. to provide timely, accurate, operating data in typewritten form, enabling operators to make production decisions with a minimum of interpretation.

5. to provide increased knowledge of the continuous annealing process which will permit better design in future annealing lines.

The system is not rigid, but can be reprogrammed to match future advances in the art of annealing and in computer control; in addition the computer is set up to recognise abnormal conditions or failures, not only in the line but also in its own performance.

The Jones and Laughlin computer works under a complex program as there are many variables in the annealing process it controls. Most industrial computers control only one or two variable factors. Experience has shown that computer control is ideally suited for the continuous annealing process where cold rolled strip steel—work-hardened in earlier processes—is brought back to a useful degree of ductility or softness. This is done at rates up to 2,000 feet per minute.

In this process, the steel is heated to a temperature between 1,100 and 1,330 degrees Fahrenheit, held at that temperature for a period of time to permit grain growth, and then cooled at a controlled rate to about 900 degrees before being cooled to room temperature. This is accomplished in four separate sections of the line (heating, holding, retard cooling, and fast cooling chambers). Strip steel thus treated is then temper-rolled to impart the proper degree of hardness, and coated with a thin layer of pure tin to become tin plate.

The annealing process is continuous, and the cold rolled steel may vary in its dimensions. Thus steel of certain gauge and width and requiring a certain specified annealing practice may be welded to another coil of steel of different dimensions and requiring a different annealing practice. The process also may be affected by chemical composition of the strip steel, variations in time and temperature of the annealing furnace, and brightness or heat-absorbing capacity of the strip. The computer system facilitates the operation of this continuous process by automatically tracking each coil of steel through the line and regulating speed through the furnace and furnace temperature to achieve the proper annealing cycle, notwithstanding the varying requirements.

The finished product is inspected and classified automatically, making quality records for each coil instantly available. The computer system also monitors line operation and collects and computes the data required to analyse characteristics of the process. Incentive and administrative records also are prepared on punched tape while the coil is in process.

The computer system is linked to furnace zone temperature regulators. A selector system also has been installed whereby any one or all furnace zones can be controlled manually. Operating data for the system (such as steel width, thickness, chemical analysis, desired annealed hardness, steel grade, and a specified line operating speed) are prepared on a punched card. The card also contains order accounting data such as the order number, heat number, incentive pay standard code, coil diversion code, and the promised shipping date.

As the coil enters the line, the punched card prepared for that order and heat number is inserted into a card reader at the entry coil holder. The operator then selects switches at the entry end for the coil number, weight, and inventory code. As the head end of one coil is welded to the tail end of the preceding coil, the welder signals the computer to ' read ' the entry card reader and the manual input data. The computer also ' remembers ' the position of the weld.

The entry section then is restarted, and the new coil enters the line. Pulse-type tachometers on the furnace section and at the delivery section provide a signal to the computer for each foot of steel that passes through these sections. The computer will track the welds from the entry weld

As a coil enters the line a card for that order with all relevant details is inserted into a card reader . . .

A coil ticket containing production and accounting data is typed automatically

through the entire line. As the weld marking the head end of each coil reaches the guides before and at the end of the furnace, the computer will check the order data to determine whether the strip following the weld is wider than that preceding it. If it is, the sideguards will be opened automatically and an alarm sounded at the operator station. The operator then can adjust the position of the sideguards. As the head end of a new coil or order reaches the furnace, the computer will reset the furnace temperature controls to the specified values, as indicated on the order cards.

Inspection devices at the delivery end of the line inspect and classify each foot of steel strip, and as the weld marking the end of each coil passes the delivery shear, the identity data fed in at the entry end for that coil are typed automatically on a 'coil log' typewriter at the annealer's station. The computer also flashes the position of each weld in the furnace by means of signal lights, and warns of a weld approach at the delivery end of the line. Thus operators can prepare for shearing operations.

When the weld at the end of a coil is sheared, the computer types out all footage classification data for that coil on the coil log typewriter at the annealer's station. The log includes the total footage in the coil, footage in each defect category if any, the coil weight, percentage of prime product, percentage of each defect category if any, and the time required for processing the coil.

A coil ticket is printed automatically with the operation of the shear at the delivery end of the line. This ticket is an identification tag which includes the line number, the mill work shift, the crew identity code, date, coil number and weight, and a coil diversion code computed from the percentage of prime product.

The computer records all furnace delays, and automatically types the clock time, time elapsed, and other delay data on the coil log typewriter. It tracks any footage which may be ruined by a delay in the furnace.

The computer also 'checks' the performance of the line every 10 seconds and every 10 minutes provides an over-all picture of the various sensing devices recorded on the data typewriter. Reliability of the computer system is increased by a series of tests performed by the equipment itself. Periodically, it performs a series of programmed calculations, exercising as many of its components and elements as possible. The resulting signals are checked against known correct values to determine any discrepancies.

The computer also is programmed to examine for reasonableness signals from the various sensing devices. An alarm is sounded if any of the sensing devices transmits an unreasonable signal.

A final protective program is known as a 'mad man' sequence. This provides for a check against the possibility that the computer may 'go mad', perform illogical operations, and lose the ability to check itself. This is accomplished by a check in operations, at certain specified times. If this check is not made, a lock-out relay is energised, and the computer is automatically shut down. Requirements for the computer were developed by J and L engineers, and the computer was designed and built by General Electric's Computer Department in Phoenix, Arizona.

Mr Beer's Axe

Twenty years ago OR techniques, first devised in Britain, produced startling and powerful results for the fighting services - now they are ignored by British industry when American and European organisations are gleaning the results of British pioneering.

NEW companies are probably launched every week, and inevitably, as soon as the papers come back from the Registrar of Companies, the form is to hold a reception to which a mixed gathering of prospective customers and press is invited to hear speeches announcing what great public good the company will do. In effect, the company's first act is a piece of verbal advertising.

True to form seemed a new organisation—Science in General Management Ltd—or as they hope to be called, SIGMA—which has been set up jointly by Martech Consultants Ltd and the French company, Société d'Economie et de Mathematique Appliquées. A reception was held, and

press and prospects were invited; but when it came to speeches, Sigma's managing director, Mr Stafford Beer, delivered a trenchant lecture that was almost purely an attack on complacency in British industry rather than the conventional verbal advertisement.

Mr Beer was until recently head of the Department of Operational Research and Cybernetics of United Steel, and Sigma is of course to be a consultancy firm specialising in operational research.

Claiming that the deliberate and systematic use of science in the solution of top management problems had now been a recognised activity for 20 years, and that under the name of operational research (OR), it had been widely applied to examine general management strategy, Mr Beer defined this approach as 'the method of working a large, complex and probabilistic system of men, materials, machinery and money as an integrated whole'.

The work differed from other forms of scientific advice: 'we are not so much concerned with technical advance in particular areas of an enterprise, as with incorporating such advances in the direction of the whole *organism*—a company or an industry much resembles a living creature, whose main object is survival in a competitive world.'

The scientific method of approach to these problems, Mr Beer stated, did not rely on intuition, acumen, or habit, but on the measurement of variables, and the detailed analysis of data; on the measurement of apparent imponderables (especially chance and risk); and on the construction and validation of formal hypotheses about the way systems worked. It employed teams of mixed scientists, competent to draw on the corpus of scientific knowledge about the way large systems behave: whether physical or chemical, biological or social, economic or electronic, anatomic or psychological.

Sigma's managing director, Stafford Beer, was educated at Whitgift and London University where he was reading Philosophy with Psychology when the war interrupted his academic career. He became involved in the application of science to military problems and remained in the Army after the war, leading operational research studies.

In 1948, he moved to industry, built one of the earliest operational research groups in private business for Samuel Fox and Co, then switched, in 1956, to Fox's parent company, United Steel, to found a Department of Operational Research and Cybernetics to serve the whole group. In five years he built up the world's largest industrial OR organisation. Mr Beer is a leading authority on Cybernetics.

In general, the method employed was to construct some kind of model of the behaviour of the entire system under study, drawn by calculated analogy with systems already understood, and expressed in rigorous terms. Models were then used for making predictions and comparisons, and for investigating the consequences of decisions. They offered a cheap, effective and safe basis for that essential activity of scientific research: experimentation.

WAR-TIME CONTRIBUTION

Mr Beer's contention is that the potentiality of OR is not always understood by the leaders of our government and industry; they neither appreciate the sheer scale of its past successes, nor grasp the opportunities it offers on that scale of maximum effectiveness.

OR was discovered during the last war, so that it is worth remembering what the 'strategic scientists' of the war really achieved. By planning defensive strategies against air attack, OR *doubled* the effectiveness of radar. By prescribing the strategy of air attack on submarines, OR increased the number of kills (said the RAF) by *700* percent. By advising the Navy on the strategy of convoys, OR procured a drastic reduction in shipping losses. And there are many other examples.

These early activities set the scale of the scientific operation in aid of management strategy. Here were the scientists tackling the large problems of command, and reporting to the highest level—the Chiefs of Staff—a process which most fortunately continues to this day.

Today we find strategic science at the service of civil as well as military government. All branches of the American administration use it, letting out work on contract to their leading OR scientists—one of whom is now Assistant Secretary of Defence. In India, OR was used to produce the five-year plans; in Norway, to create a strategy for minimising the national debt; in Egypt, for apportioning priorities to national planning targets.

In France there is a national economic planning body, the Commissariat au Plan, which has successfully organised the country's economic growth at a rate more than double ours in Britain.

As to industry, Mr Beer claims that the use of science in general management has successfully im-

parted direction to capital development schemes, and the apportionment of expenditure generally. ' It has been used to evaluate research programmes, it has created control systems, and revolutionised transportation strategies by land, sea and air. Buying policies, selling policies, production policies; competition, collaboration, and amalgamation; labour relations, the introduction of automation, and the structure of the organisation itself—these are all aspects of industrial strategy which have proved susceptible to operational research.'

OR IN BRITAIN TODAY

Britain—the begetter of strategic science—is still the home of a large force of OR scientists. The Operational Research Society of Great Britain has nearly 700 members, nearly 400 of whom have practical experience in leading OR projects, and there are more workers in the field who do not belong to the Society.

However, Mr Beer believes this force, in the civil sphere, is unfortunately wasted: ' The famous British philosophy of stately caution leads to mere trials of OR—even after 20 years. Many of the exercises set for it are trivial. Many are distinguished by a lack of intention, or of the necessary drive, to do anything with the answers. There is a disinclination to let any scientist, however short his haircut, too near the seats of authority where alone the strategic problems become apparent. Thus in British industry, in striking contrast with some other countries, much OR reports at a level which can neither recognise a strategic problem nor encompass the execution of its answer.'

Resistance to change may be inevitable, but ours Mr Beer judges to be disproportionately high: ' we are not adapting as fast as our competitors abroad. When we meet competition, on which our society is said to be based, we label it " unfair " and do nothing. When we meet our own inventiveness and originality, on which that society was once made prosperous, we take flight—and the advantage goes abroad.'

At a time when ' economic regulators ' are handled with the finesse of a chimpanzee at a typewriter, Mr Beer does a service to emphasise Britain's chronic situation, and his comment that ' judged by international standards of expansion, Britain's expansion looks like decline ' is just. What is required is not to play about haphazardly with regulators but to diagnose as has never been done before the whole economic system, and then once this has been done to devise or plan corrective action.

' We need ', in Mr Beer's words, ' more sophisticated measures of productivity, the proper analysis of which in systematic detail can reveal what action should be taken to improve matters . . . full time constructive work on these problems . . . a scientific attack to lift the issues clean out of the area of controversy and drift, setting them on a new plane where confidence and right action becomes possible.'

All this can be done at the level of government, of nationalised and private industry, and within individual companies themselves. At the moment, too many problems are simply fermenting—and the whole national mechanism is running down. Britain is losing out—not to superior ability, and not often to better resources—but to more intense managerial effort backed by more virile science. Look at the signs: it takes longer and longer to get anything done. Our capital and production resources are tied up for twice as long as they are in other countries in doing the same tasks—constructing a power station, building a ship, exploiting inventions. . . .'

No one would deny that Mr Beer has an axe to grind, but this is compensated by two factors: his axe is worth grinding; and he is that rare creature—an articulate scientist with an almost global perspective.

THE REMOTE CENTRE

Continued from page 11

One of the more interesting applications is likely to come about when a Ferranti Argus computer is installed as a comprehensive co-ordinating data logger for one of the major chemical plants.* Data logged by the Argus system will be put on to magnetic tape, at ICI's Fleetwood plant, and will be passed to the Mercury Centre, which will carry out a very elaborate figure breakdown, based on a special optimisation program. From the findings produced on the Mercury it will be possible to see whether the plant can be operated more efficiently, or whether the plant or its control system should be redesigned to optimise its performance. Though this is not quite computer-to-computer transmission, it seems to presage new developments in computer-computer interdependence.

Another possible function of the Mercury Centre is to act as a standby in case of breakdown for other computers within the group. It is possible to run autocode programs designed for the smaller Pegasus scientific computer on the Mercury, and this means that if anything were to happen to that computer, the Mercury could take over those of its functions which were executed in autocode. Similarly, the Mercury is able to accept autocode programs written for the Sirius computer, one of which is just en route for ICI's headquarters in Australia. It is considered that it may become practicable for really long autocode programs written for Sirius to be sent to the Mercury for handling. If this transpires, the Wilton centre will become the first intercontinental and intercommonwealth computer launderette.

* See AUTOMATIC DATA PROCESSING, March 1961, page 6.

WHAT'S NEW

in systems, services and equipment

After the Exhibitions Close . . .

Is there an optimum size for exhibitions? Last month with two exhibitions running in double harness at Olympia this was a fair question to pose. The Computer exhibition with its 56 exhibitors spread over two floors, was just about the right size for the passers-by to assimilate exactly what each company had to offer. Strangely enough, the company who made most efforts to ensure maximum visibility—with crash barriers, counters, outside which the common people were to be confined—was the one who defeated its own object, since every self-respecting executive felt it necessary to his amour-propre to jump over the rope to talk to his friends inside. By contrast the Business Efficiency Exhibition, in the main hall, seemed packed tight with exhibits and even the larger stands seemed crabbed and confined. Perhaps 156 exhibitors is too many for visual comfort.

The coinciding of the two exhibitions presented firms with interests in both fields—data processing and office equipment—with a dilemma. Should they go in both exhibitions, and if so, where should the division be made as to what goes where? Most firms had stands at both exhibitions, and smaller and less expensive equipment generally gravitated to the BEE stands. IBM and ICT made the division along conventional lines, including only punched card equipment at the BEE, and only computers, and cheque sorters and data transmission equipment in the computer exhibition. This resulted in the anomaly that ICT's new small computer, the ICT 558, was featured at the BEE.

A few manufacturers appeared at only one of the exhibitions. This meant that the Monrobot computer, a small commercial computer, had its debut at the BEE, as did the new Ultra range of low-cost data processing equipment.

The basic impression we gained was that this was a streamlining, rather than a breakthrough, year. Much that was shown was a variation or improvement of existing equipment: the production model of the Rank Xeronic, shown in prototype in 1958, production models of the Creedomat and the Creed 1000 printer, from the 1960 BEE's prototype: a production model based on the Creed Doris: and slower speed models of accounting machines —the IBM 444—and of card readers and tape readers from Associated Automation. Machines like the ICT 1301, the KDP 10, and the De La Rue Bull 300 were not new, but had their first public showing.

New Computers on the stands

New computers announced were almost all small and inexpensive machines, suitable for the brain centre of a small organisation, or for scientific and teaching college applications: the ICT 558, a punched card computer suitable for performing calculations on data presented on 40-column cards: the Monrobot Mark XI, costing £15,000 and designed for both commercial and scientific use: the KDN2, announced by English Electric just before the computer exhibition, primarily intended as a scientific machine for the direct control of industrial processes and other real time applications: and Computer Engineering Ltd's CE 102 machine, costing £8,500, and designed for technical colleges.

The ICT 558

THIS computer is an internally stored program machine, consisting of two basic units, a card/reader punch and a central processor. A second card reader/punch can be fitted to the processor to give added flexibility of input and output. The computer accepts data from 40-column punched cards, and punches out the results of calculations into the same cards or into new cards. Program instructions are also entered into the computer via the medium of cards.

The central processor consists of the program storage, a ferrite core store capable of holding 256 program instructions each of 16 binary digits; a distribution unit; a data storage core store of 64 registers, each register holding 10 decimal digits and signs; an arithmetic unit capable of handling directly numbers in decimal or sterling notations; and output storage consisting of an output buffer of eight registers.

Depending on the requirements of the user considerable flexibility can be offered in the specification of the processor. The program store can have a capacity of only 128 instructions, if the work does not warrant more; likewise the data storage can be halved. When dealing with sterling, amounts can be held in the data register in one of four scales; in the arithmetic unit also the pence digit may be fixed in any one of four different positions under operator control.

The card-reader/punch comprises an input hopper with a capacity of 1,000 40-column cards, which feeds cards through at a rate of 540 cards per minute to the sensing station, where they are sensed by 12 photo-electric cells. After sensing the cards pass to the wait station, and thence to the punching station headside on. Information will then be punched into the cards at a rate of 135 cards per minute and the cards are fed to twin output receivers. These hoppers can be operated automatically or under program control, when a sorting operation can be carried out. The cycle time for one card to be processed is 111 milliseconds. Two decimal or sterling amounts can be added in about 280 microseconds, and an average multiplication takes about 0.015 seconds.

The use of the ICT 558, say the makers, may allow operations such as summary card punching, to be carried out as part of the calculating run, and can cut down reproducing punching prior to invoicing, producing a master pack and invoice pack as output—by using two card reader/punches. Sorting and internal punching can also be saved. The applications of the 558 can range over billing, invoicing, sales analyses and stock control, costing and other requisite calculations and operations.

For further information tick K01 on the reader enquiry coupon on page 39, or write to:
ICT Limited,
149 *Park Lane,*
London, W1.

The Monrobot . . . Small computer, big memory

The Monrobot XI

THIS is a small desk-sized stored program digital computer small enough to be housed in one executive-sized office desk. It is transistorised throughout and can be plugged into a standard wall socket for operation; no cooling or air-conditioning equipments are required.

The computer consists of a central processing unit and up to three input and three output devices. The arithmetic unit is a solid state logic unit operating sequentially in serial arithmetic mode with an add-subtract time of 3 milliseconds, and a multiplying time of 28 milliseconds plus six milliseconds storage access time. This means that 5,000 additions, or 2,000 multiplications per minute can be performed. Fixed point or programmed floating point arithmetic systems can be used. The computer operates in binary with a word size of 32 binary digits, including sign; instructions are of 16 binary digits length, two making up one word; 27 instructions are used.

The storage is via a magnetic drum, which holds 1024 words of 32 bit length (nine decimal digits or five alphanumeric characters). This gives the Monrobot a considerable storage capacity for totals, constants, and program steps for a machine that costs £15,000. It is possible to store several programs simultaneously and invoke them in turn by pressing a button on the control keyboard. Data can be stored in the memory in

The ICT 558 . . . 40-column cardsharper

The CE102 . . . For the schoolroom

one form, can be written out in another, *ie.* dates written in alphabetic form can be printed out in numeric, as required.

Entry to the computer can be via a tape reader, reading tape of any known code at a rate of 20 characters per second; a typewriter and/or an auxiliary 16-key numeric keyboard; a teletypewriter; or an 80-column card reader. Any three of these equipments can be operated simultaneously as input to the computer; in the same way output can be to three media, tape punch, typewriter, and/or teletypewriter, and/or card punch, and simultaneous printing can be carried out to different formats.

The computer costs about £15,000 and delivery from the USA is promised in six months.

For further information tick K02 on the reader enquiry coupon on page 39, or write to:
Monroe Calculating Machine Co Ltd,
Bush House,
Aldwych,
London, WC2.

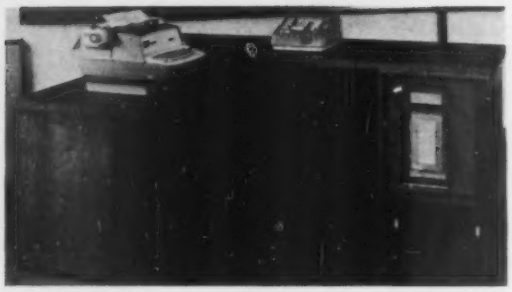
The CE 102

A COMPUTER costing only £8,500 and designed to give long periods of trouble free running ' with the possibility of mal-use ', has been designed by Computer Engineering for the technical college or the small industrial firm. Very small and compact—it is no larger than an ordinary desk—it is a solid state stored program machine with a 4,092 word magnetic drum store. It operates serially in binary notation, with negative numbers represented by their complement in respect of two. Each word in the store is equivalent to an 8 digit decimal number.

Input is via a high speed tape reader, reading standard 5-channel tape. Output is to an electric typewriter, or teleprinter with or without reperforating facilities. No special air-conditioning is required, and the computer can be plugged into a standard wall socket.

The logic design of the machine gives great flexibility and simplicity of programming. The instruction code is a machine code with 13 functions, comprising a word of 32 binary digits, the number of functions is a compromise between simplicity (with prolixity) and complexity (with conciseness). Each instruction refers to a single address, and there is a single working accumulator. One of the features of the instruction is automatic address modification, since each instruction word incorporates a digit which can be used for this (B modification) purpose; thus any address can be so modified.

For further details tick K03 on the reader enquiry coupon on page 39, or write to:
Computer Engineering Ltd,
Stranraer House,
Stoney Road,
Bracknell, Berks.



The desk model Clary DE60 . . . Also available in trundle-around form for factory workbench

Computer on wheels

A DIGITAL computer which is self contained and portable, and can be wheeled around to the section where it is required, is announced by Block and Anderson. This machine, the Clary DE 60, has been proven in the USA, where it is used primarily for scientific and engineering work, aerial programmetry, civil engineering, linear correlation and linear regression in process control, stress calculations in aerodynamics, and general mathematical calculations such as the solution of linear equation systems with four unknowns, numerically evaluating integrals, etc. However, it can also be used for such business applications as sales and costs analyses, market research calculations, depreciation schedules and any other applications.

The computer allows for direct entry by a numerical keyboard or by an electric typewriter, and automatic output via the typewriter. The machine is able to act both in the manner of a calculator and as a computer. It can store data, compute, compare, iterate, hold or transfer information and instructions as required by the program.

There are two models of the Clary DE 60, the standard desk model, and the mobile unit, the DE 60M. The machine can be plugged into any standard electrical plug-socket, and can operate under normal working conditions, without the need for special air-conditioning. The cost of the machine is given as around £11,000.

For further details tick K04 on the reader enquiry coupon on page 39, or write to:
Block and Anderson Ltd,
Banda House,
Cambridge Grove,
Hammersmith,
London, W6.

Revolutionary Tape Unit

OF many exhibits the AEI ECM 64 unit, known as the ' Carousel ' was perhaps the most novel. This is a 64-in-one magnetic tape storage unit, which could revolutionise low volume data storage and updating, particularly of a large number of categories.

The tape unit has a revolving platter on which are fixed, either permanently or in a detachable form, 64 small tape reels each holding 29½ feet of magnetic tape, $\frac{5}{8}$ inches wide, having eight read/write tracks.

When a computer interrogates the tape unit the platter moves round the shortest way until the appropriate reel is level with the read-write head. The tape reel is weighted and the tape falls, of its own momentum down specially designed guides past the read-write head, until it is pressed by a punch roller on to a rotating capstan which winds off the tape to the tape reservoir. As the tape falls the reading or writing operation is carried out; an external order rewinds the tape to the starting position,

allowing the next operation to begin. The read-write head has eight tracks one of which is usually employed in parity checking. The read-write operation takes from one to three seconds to perform. An air-gap allows tape to pass the head at a fixed distance, thereby protecting against tape wear and allowing the passage of large dust particles.

The advantages of this system lie in the flexibility which it offers, since each reel is a self-contained unit entirely separated from the memory. Again where it is desirable for a copy of the cash register to be retained during an updating run—an operation requiring two tape units. The Carousel can replace it is claimed up to four tape units, where data have to be sorted prior to a serialised updating. A particular application where it would be indispensable is where a record department needs to catalogue by categories, since the 64 tape units, can be used, and subdivided at will.

A saving in air-conditioning costs can also be achieved, since the Carousel operates effectively at room temperature.

The Carousel costs in the region of £12,000 to £13,000, and delivery time is given at about six months.

For further details tick K05 on the reader enquiry coupon on page 39, or write to:

AEI Ltd,
Rugby,
Warwickshire.

Quick or slow

A DEVICE to enable magnetic tape recordings to be written and read at widely different speeds is the Ultra static read-write head. This equipment allows reading to be made from a slow-moving or even a stationary tape. In this way tapes can be made compatible both with high speed digital computer input or output, and also with low speed typewriter or teleprinter operation.

For further details tick K06 on the reader enquiry coupon on page 39, or write to:

Ultra Electronics Ltd,
Western Avenue,
London, W3.

New data acquisition system

COMING to rival the established Friden and Addo data acquisition systems are a number of interdependent equipments, which can serve as low cost data processing equipments in their own right or as merging and editing equipment producing tape for computer input.

The equipments designed by Ultra Electronics comprise solenoid operated add-listers such as the Ultra Olivetti Elettrosumma 22; a 5-channel encoder punch, the UE 877; and the 10 channel data selector, the OE 875, with a master keyboard machine, the UE 871, designed on the lines of the Elettrosumma 22; and the Ultra Datawriter, a converted Olivetti Lexicon 80E, which is able to serve either as input or output printer to the system. In addition, Ultra have produced a tape merging equipment which compares, copies and amends punched paper tape, which can form part of the complex as required.

The Datawriter is able to be coupled to the tape punch to produce by-product 5-channel tape as a result of manual typing. Using the Ultra static read-write head it can also record encoded data on magnetic tape for computer input, and can transfer information to add-listers or calculators. Alternatively it may be coupled both to the tape punch and a remote controlled add-lister, so that calculations may be carried out and both the original manual data and results punched on to the tape output.

In the same way, by the use of a programming unit, keyswitches and typebar solenoids, the Datawriter can operate from electrical signals derived via a decoding unit from punched or magnetic tape. In this way it can not only produce a typed output such as invoices, bills, or receipts, linking up with an add-lister to allow calculations to be made and transferred, but also will produce an edited by-product tape, which can later be fed back into Datawriter for a subsequent summary print out. The Datawriter costs from £315 to £475 depending on the amount of flexibility in input/output required and solenoids, key micro-switches, programming units, and inhibitors, special keys, etc, which must be incorporated.

The paper tape punch, the Type UE 877, is a low cost equipment which is likely to be used outside the data acquisition system for a variety of computer applications. It has built-in coding facilities, and can operate in conjunction with Data-writers, add listers, and cash registers. The paper tape punch costs £240.

The Ultra 877 . . . Many applications paper punch

The hub of the data acquisition system is the data selector and numerical keyboard. This enables information coded on paper tape to be selectively routed into any of 10 output channels by means of code numbers inserted between successive blocks of information, which can feed the UE 877, punch the Datawriter, or the add-lister. The numerical keyboard produces the impulses for activating these remote machines, or to transmit and print data at various points in an organisation.

The machine can also serve as a remote control for the E22 add-lister. The data selector costs rather less than £1,000 with the numerical keyboard costing an additional £175.

The complex can thus be used for sales analyses, printing group sales and automatically inserting value of orders received—the information coming from tape readers via the data selector with a numeric transfer between add-lister and upper case data writer ending with a print out by the typewriter; or for allowing data originating at various points of sale to be assembled and edited into a tape suitable for computer input.

For further details tick K07 on the reader enquiry coupon on page 39, or write to:

Ultra Electronics Ltd,
Western Avenue,
London, W3.

CONTINUOUS STATIONERY

MANUFACTURERS of continuous stationery face a challenge from two fronts. The Xeronic printer using a microfilm device is able to provide from six to 36 different format of form, printing the form heads and static data, as part of the print-out run. Only the very large firms, however, are likely to be able to afford the Xeronic.

A more formidable competitor, in the smaller business field, is the Banda Overprinter. This allows sprocket punched forms from 3 inches to 13 inches wide and 4 inches to 16 inches deep to be printed continuously and collated into up to eight part sets.

Printing is done from rubber stereo plates which can be held for invoices, statements, credit notes, etc. The machine can also be used, in conjunction with a guillotine, to produce single sheet pre-printed forms of all kinds. The disadvantage of the system is that stapling of one-time carbon is not possible as an integral part of the operation. The makers suggest this can be overcome by the use of no-carbon required paper or heating carbons.

The machine is particularly useful to O and M officers who want to prepare experimental short runs of forms. Since it saves the need for holding large stocks of different forms—which may become obsolete overnight, if amendments to the procedure are made—the makers reckon that up to 25 percent in stationery costs can be saved. The cost of the Overprinter is given as £1,595.

The Overprinter . . . For do-it-yourself stationery

For further details tick K08 on the reader enquiry coupon on page 39, or write to:
Block and Anderson Ltd,
Banda House,
Cambridge Grove,
London, W.6

Carbon ribbon device

MOST of the newer equipment on the stands, the Paragon Paraflex stationery and decollator, the Fanfold Fimafold, Weber tab-on stencil, though exhibited for the first time, have already been reviewed in these columns. However, Fanfold did produce a new form system at the exhibition, the cross-ribbon pinwheel platen.

The device is designed to handle from two to seven part continuous forms, dispensing with the need for carbon gloves, floating carbons or one time carbon sets. As its name suggests the device consists of a pinwheel platen combined with carbon ribbons, which travel between the forms in a state of constant tension. The forms are maintained in register by the platen, the tension of the ribbon preventing it from being drawn up even when forms are wound back into the platen.

For further details tick K09 on the reader enquiry coupon on page 39, or write to:
Fanfold Ltd,
Bridport Road,
Edmonton, N.18.

OUTPUT PRINTERS

MOST noticeable at the Electronic Computer Exhibition was the prevalence of the Anelex high speed printer on computer stands. This printer, which was first adopted in Britain for the prototype Leo III, is now the standard output unit for the Emidec 1100—replacing the Samstronic which was used for the Boots installation—and is also to be used with De La Rue Bull and Ferranti installation. An American machine of tried performance, it costs upwards of £10,000.

Shown for the first time to the public—though a chosen few have seen it in operation at Kidsgrove—was the English Electric automatic printer which is to be the standard output for both KDP 10 and KDF 9.

This is a fully transistorised machine which operates on line, controlled by the computer, either directly or from a punched tape loop in the computer.

The print roller consists of 120 axially mounted rings, each of which have 51 printed characters, thus enabling 120 characters per line to be printed out at a speed of 600 lines per minute.

The 51 characters comprise the 26 alphabetic characters, the figures 1–10, and 15 punctuation marks and symbols, brackets, quotes, ampersands, pound signs, etc. The roller method achieves a vertical alignment of plus/minus 0.008 inch.

Print out can be on single sheets or multiple sheet fanfold, comprising up to four-part sets. The size of sheet can vary, in multiples of ½ inch to allow for the standard sprocket hole distance, in up to 17 inches in length, and from 3 inches to 22 inches in width.

For further details tick K10 on the reader enquiry coupon on page 39, or write to:
English Electric Ltd,
English Electric House,
Aldwych,
London, WC2.

Golf ball machine

ANOTHER revolutionary output printer, for interruption print out, is the new IBM typewriter, known popularly as the 'golf ball' typewriter, which is to be used on the IBM stretch computer, and other large data processing units. The typewriter, the IBM 72, has a usable speed of 180 words per minute. The typewriter dispenses with typebars, and uses instead a spherical single element typing head on which are all the 88 characters of the keyboard. As a key is struck the typing head rotates and lifts bring the character into position for printing. Should two keys be struck almost simultaneously, the second letter is stored and then automatically typed.

The head is mounted on a carrier

which moves along a cylindrical rod. A clip-on ribbon cartridge is mounted on the carrier, thus making ribbon changing a simple matter. This means that several coloured ribbons can be used for one page of type. The typing head can also be changed very easily by taking it out of the carrier and replacing it by a different type style.

This typewriter, which caused a great stir at the BEE, costs from £171 to £189.

For further details tick K11 on the reader enquiry coupon on page 39, or write to:
IBM United Kingdom Ltd,
101 Wigmore Street,
London, W1.

Styli printer

FINALLY an electro-mechanical printer which has passed from prototype to production model. This is the Creed 1000, printing out serially, as its name suggests, at 1,000 words per minute.

The printer uses a five by five grid of 25 rectangular pins, which are pressed against a typewriter ribbon, in response to external 6-unit signals received via flexible nylon tubes activated by 25 electrically operated valves. The line length offered by this method is for 10–150 characters per line. Up to four copies can be obtained from the output using interleaved stationery. Form throw is controlled by interchangeable metal programs, which allow for up to 33 settings for automatic form throw (range 2–66 lines in multiples of two lines). An interchangeable bail bar allows up to 150 settings for horizontal tabulation.

The whole printer unit has been streamlined with the motor control gear, control circuitry and power pack incorporated in the console on which the print unit stands. The console also incorporates a drawer for which the stationery is fed into the printer. This drawer can hold up to 2,000 pages of stationery. The usual controls, a manually operated rotating switch for Off, Run, and Busy, pushbuttons for line feed, print-head return, tabulate, form throw and space, and lengths for alarm signals—paper low and hydraulic pressure low—are also incorporated on the console.

• Though the Creed 1000 has been designed as a medium speed, moderate price, off-line computer printer, one of the things that arose from the exhibition was that many people were interested in the equipment as an end-of-line printer for a high speed data transmission system. Creed say that there is no reason, mechanically, why the printer should not be used for this purpose, with very little adaptation.

The cost of the Model 1000* is given as from £3,500.

For further details tick K12 on the reader enquiry coupon on page 39, or write to:
Creed & Co Ltd,
Telegraph House,
Croydon,
Surrey.

Electronic desk calculator

CLAIMED to be the first electronic desk adding calculator, the Sumlock Anita aroused a great deal of interest at the BEE. It is able to add amounts up to 999,999,999,999, and is the only pre-set calculator with direct addition and subtraction, automatic decimal pointing, automatic division, and instant multiplication. Sterling/decimal conversion is one of the applications for which this machine will be specially effective, and provision is made on the calculator for the entry of a sterling decimal conversion table. A low cost machine, it retails at £335.

For further details tick K13 on the reader enquiry coupon on page 39, or write to:
Sumlock Comptometer Ltd,
39 St James's Street,
London, SW1.

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How Near is Machine Translation?

Continued from page 24

language analysis by algorithms.

The British contribution to the conference was six papers: three from Cambridge, chiefly on basic research into the intricacies of Language and Interlingua, two by the National Physical Laboratory on the splitting of Russian words and on the interpretation of fragments and one by Birkbeck College, an old-established club for numerical integration and mechanical resolution of linguistic problems.

RESULTS AND TREND

The first machine translation was demonstrated in 1954, using a dictionary of 250 words. A few simple sentences of identical structure were given to the machine, which produced a word by word translation in fairly readable English.

In 1961 a translation was demonstrated, using a dictionary of 5,000 words, and producing a word-to-word translation of a passage from *Pravda*, *ie.* translating structures of some, though restricted, variety. The result, a little bruised but understandable, was printed out at a rate of about 1,000 words per minute. The speed was obtained by pre-recording on tape the original Russian article.

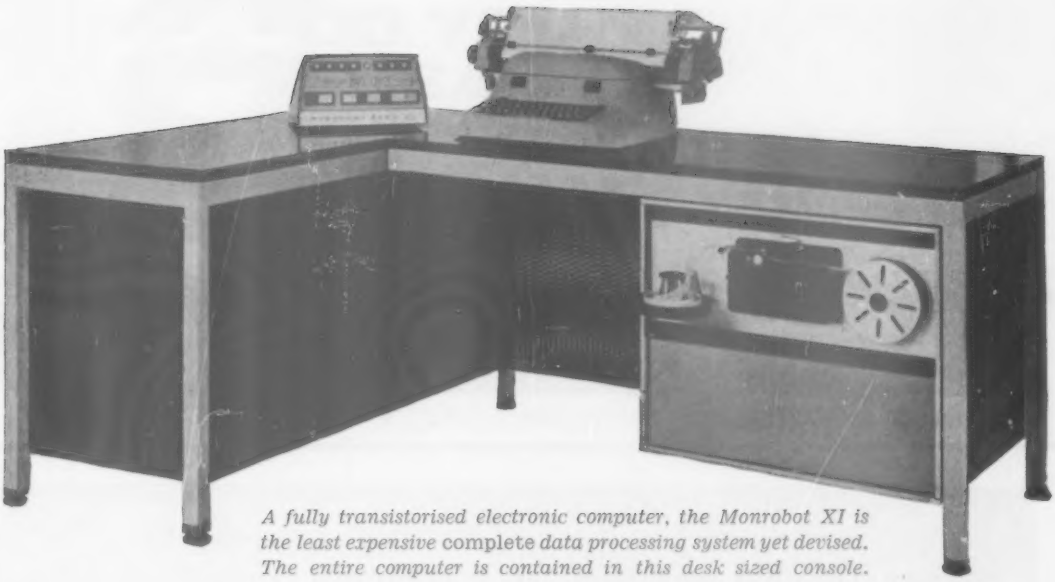
Leaving aside any ambition to translate poetry, or even to obtain prose of literary merit, and restricting our ambition to a purely utilitarian application, we have reached the point where. under favourable conditions, a Russian text can be transferred into English by machine. An expert in the subject will understand the text and should be able to edit the machine version for use by a wider public, if needed.

So far as can be seen at the moment, a machine, being programmed by a limited set of rules, will have a style of its own. Following essentially the original word order, it will produce a characteristic word pattern of prose or ' style '—that will be as characteristic as the ' styles ' of Shakespeare, Goethe or Dante, though not necessarily as pleasing.

Apart from the purpose of translation, the techniques now available and under development will be found useful in providing material for abstracting scientific literature and for automatic information retreival.

As a by-product, we know now more about language than we knew before, and will learn a lot more in future. Another aspect is that with advances in speedy analysis, it may be possible to print the *spoken* word, read into a machine, so that even the spelling is correct.

The full text of the papers and discussions of the Conference on Machine Translation and Applied Language Analysis will be published by HM Stationery Office next year.



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Due to its versatility and low cost the Monrobot XI is equally suited to use in small businesses, to perform a complete data processing job; in a large computer installation as ancillary equipment used for data conversion, editing, or proof; or in branch offices to ensure accurate and standard record keeping and the production of output which can later be processed and analysed at the Head Office.

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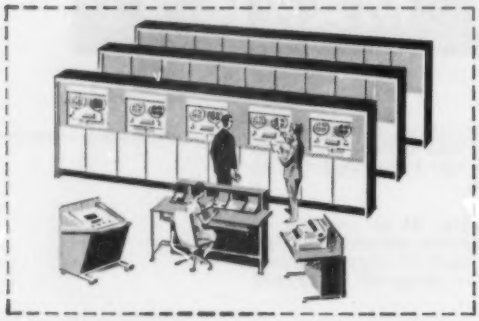

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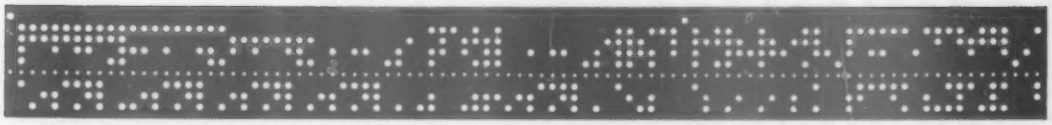

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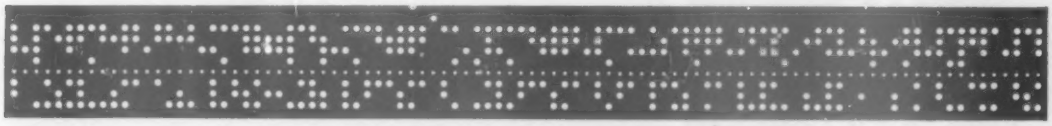

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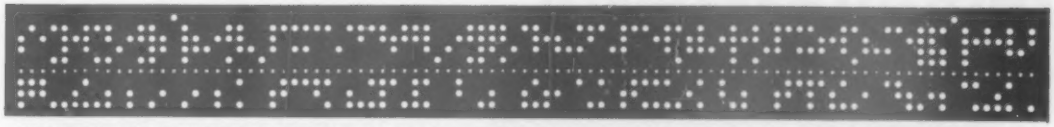

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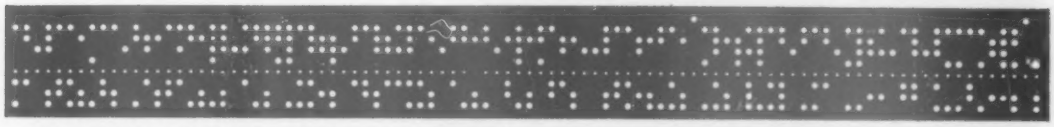

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Further details from the
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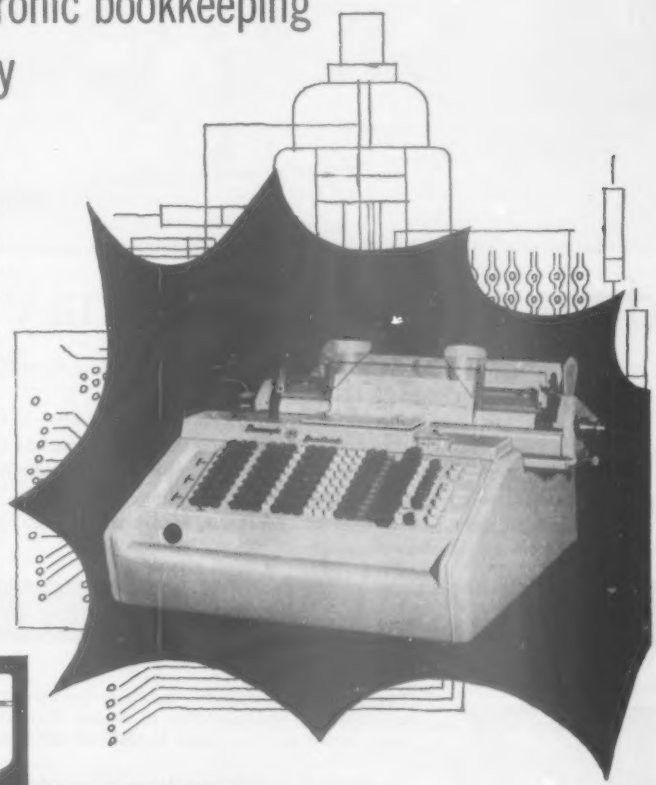

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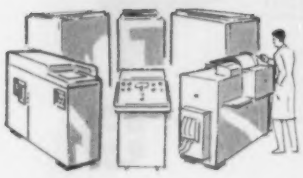
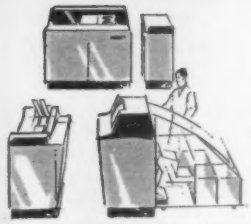


The Gamma 3 Computer *(left)* is an electronic calculator with variable drum storage of up to 200,000 decimal digits and a basic on-line printing speed of 150 lines per minute.

The 300 D.P. Series *(right)* is an expansible unit system, fully synchronised at a speed of 300 cycles/lines a minute: though rates of reading, calculating and printing may be increased by using further units. Storage is available in the form of a magnetic drum or tape units.



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